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ABSTRACT

Designed to propose ways for the Colorado Department of Education to provide leadership in the implementation of a statewide educational telecommunications network, this study examines ways in which telecommunications can be used by the state department of education, school districts, libraries, and other informational or educational agencies to meet a variety of needs. THe focus is on the creation of a network strategy, rather than a network infrastructure, and the use of telecommunications to solve existing problems or to provide more efficient and cost-effective service to all Coloradans. The first of two major sections, the Executive Summary provides a complete overview of the scope of the study and includes all of the recommendations. The recommendations are grouped into eight categories: (1) State Board of Education; (2) Colorado Department of Education; (3) Local Decision Makers; (4) Funding Strategies; (5) Instructional Delivery; (6) Access to Resources; (7) Teacher and Librarian Education/Staff Training; and (8) Implementation Strategies. Timelines for five years are included. Focusing on implementation strategies, the second section provides information on the history of telecommunications studies in Colorado, current telecommunications projects in the state, and options considered, as well as a detailed treatment of each of the recommendations. (91 references) (EW)

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COLORADO EDUCATIONAL TELECOMMUNICATIONS STUDY

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OCTOBER, 1986

EXECUTIVE

SUMMARY

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EXECUTIVE SUMMARY

This Study recommends development of a "statewide educational telecommunications network". The term, as used in this Study, describes an **operating philosophy** and an **overall planning strategy**. This Study does not recommend development of a statewide technological entity to meet instructional and informational needs. The Colorado Educational Telecommunications Network mentioned in this Study is conceived as **the sum of all the parts** of a carefully organized planning effort. The planning result will be a cohesive network strategy, not a network infrastructure.

GOALS AND OBJECTIVES:

Based on the research that has been conducted and the input from nearly 100 educators and librarians across the country, the following Goals and Objectives are recommended:

GOAL #1: The CDE, in cooperation with potential users, will develop and implement an educational telecommunications network for delivery of instructional and informational resources to all Coloradans regardless of age, physical disabilities, geographic isolation, educational attainment, or primary language.

Objective 1-A: To examine existing educational telecommunications projects and programs to identify those which would best meet the needs of Colorado's schools and libraries.

Objective 1-B: To coordinate with other agencies, organizations, and associations planning projects in the area of educational telecommunications to eliminate the chance of duplication, overlap, or conflicts.

Objective 1-C: To consider how the unique properties of telecommunications can be utilized to bring equality of instructional resources to students in grades K-12.

Objective 1-D: To determine how the emerging statewide library network can provide equality of informational access to all Coloradans.

GOAL #2: The CDE will develop and implement an internal office automation and automated data processing system which will support effective telecommunications linkages between the CDE and its constituents at all levels.

Objective 2-A: To determine how the CDE uses technology/telecommunications presently and identify how those efforts can be increased and improved.

Objective 2-B: To consider how CDE staff resources and internal organization can be harnessed to enhance implementation of the statewide educational telecommunications network.

Objective 2-C: To identify other telecommunications services and resources that could be utilized by CDE staff in providing technical assistance to constituents.

PREFACE

PURPOSE:

The purpose of this Study is to propose ways in which the Colorado Department of Education can provide leadership in implementing a statewide educational telecommunications network. The Study will examine ways in which telecommunications can be used by the Colorado Department of Education, school districts, libraries, and other informational or educational agencies to meet a variety of needs. The Study's goal is not to recommend that Colorado's schools and libraries should use technology or telecommunications. Rather, the purpose is to identify how telecommunications can be used to solve existing problems or to provide more efficient and cost-effective services to all Coloradans.

APPROACH:

This Study is organized into three Sections: Executive Summary, Implementation Strategies, and Appendices. The Executive Summary provides a complete overview of the Study's scope and includes all recommendations. It is aimed at decision-makers and others who want a concise report. The Section on Implementation Strategies is intended for persons who desire a background information and detailed treatment of the various components related to educational telecommunications. The Appendices contain the names of persons contacted for input to the Study, summaries of several projects in other states, and other helpful information.

A pragmatic approach was taken in writing this Study. The contractor did not view telecommunications or technology as futuristic or gimmicky because they are already an integral part of our daily lives. Technology can be as simple as a pocket calculator; while telecommunications is as basic as the telephone.

The contractor did not view telecommunications as a "cure-all" for educational or informational ills. Poor teaching will still be second-rate when transmitted via satellite. Online catalogs will not make access to information better if libraries are unwilling to share their resources.

DEFINITIONS:

Audio Conferencing: The use of telephones--usually equipped with speakers--to provide interactive instruction. Several successful instructional programs in other states have utilized this relatively inexpensive technology successfully.

Colorado Department of Education: For the sake of brevity, CDE is used to identify the Colorado Department of Education in this Study. The Department includes the organization, in its entirity, as well as its individual parts, such as administration, staff, committees, etc.

Computer Assisted Instruction (CAI): This term is used to describe a

situation in which computers, usually microcomputers, are utilized to provide a variety of learning experiences. The student may be doing workbook-like activities, may be practicing a foreign language with a voice synthesizer, or may be communicating with a distant teacher via electronic mail.

Educational Telecommunications: "Education", as used in this Study, should be interpreted to mean life-long learning. If formalized instruction is intended, the term "instructional telecommunications" is used. Instruction does not apply solely to K-12 students, since teacher education, special education for pre-schoolers, and adult basic education or high school completion are important components of instructional telecommunications.

Interactive Video: This technology, either via satellite or direct broadcast, most closely approximates the traditional classroom setting. The state of Minnesota has implemented a number of successful interactive video projects, but other states have not replicated this model because of the high costs involved.

Telecommunications: It is difficult, if not impossible, to separate "telecommunications" from "technology". Telecommunications is merely the vehicle used to deliver technology from one point to another. Therefore, the contractor has examined both automation (technology) and the systems needed to deliver automation (telecommunications). The focus of this Study is telecommunications, but technology issues are examined as they impinge on one's ability to utilize telcommunications effectively. Hence, the contractor has addressed some issues that are related to office automation or automated data processing (ADP) simply because they impact on the ability of the Department of Education or local schools and libraries to address recommendations in this Study.

METHODOLOGY:

It is a challenging undertaking to gain an overall perspective on educational telecommunications in America. First, there is no centralized source of information, and second, the subject is so dynamic that it is difficult to capture.

Initial activity was to conduct an exhaustive literature search of all relevant areas. This yielded a large number of articles describing a variety of projects currently operational or under development. In addition, a review was conducted of the findings and recommendations of all known committees and task forces which have been convened in Colorado over the past twenty-five years (1960-1985).

The second step was to interview persons in Colorado, including CDE staff, who could identify promising projects or who had suggestions as to what components should be contained in a statewide educational telecommunications network. In all, nearly 100 people were interviewed, either in person or by phone.

Thirdly, visits were made to many of the identified projects, both in-state and out-of-state. In every instance, practioners and administrators were interviewed to provide a broader perspective of the project.

ISSUES CONSIDERED

The contractor considered a wide variety of approaches to using telecommunications in the delivery of education and information in Colorado. Several issues were given special attention because they would influence the Study's scope and direction. Those issues are outlined below:

A SINGLE DELIVERY SYSTEM IS NOT VIABLE: Alaska has been successful in mounting a unified statewide telecommunications network, but it received large infusions of state and federal funds. The contractor feels that such massive funding is not realistic in Colorado; hence, development of a unified statewide system is not recommended.

TOP-DOWN IS THE BEST APPROACH: Even though Colorado has a long history of local control, development of a statewide telecommunications network requires a "top-down" approach. The Department needs to paint a picture of what a statewide educational telecommunications network will do, what it will be, and what each participant can contribute and gain from it. This cannot be accomplished by a laissez faire attitude; strong visionary leadership is required.

TELECOMMUNICATIONS CAN ADDRESS QUESTIONS OF EQUITY: Colorado should use a statewide educational telecommunications network to address recurring questions concerning instructional and informational equity. Technology can overcome geographic barriers, disparities in population density, inequalities in access to information, and other factors. It can also be utilized to enhance the quality of life for handicapped or homebound children and adults.

EXPERIENCES OF OTHER STATES CAN BE USEFUL: One of the advantages Colorado has by coming onto the telecommunications scene rather late is that it can benefit from the explorations and findings of other states. There is no need to fund pilot or demonstration projects prior to implementation of the network. If Colorado educators or librarians wish to see telecommunications or technology in actual use, there are a multitude of sites for visitation in neighboring states.

RESOURCE ACCESS IS IMPORTANT TO EDUCATIONAL TELECOMMUNICATIONS: One area that has been neglected in some other states is access to resources. Access becomes more critical to students and adults in rural areas who may have sophisticated information needs, but limited library resources. Colorado's past planning for a statewide library network will stand her in good stead, because the groundwork has already been laid for providing access to the statewide wealth of library holdings that support the needs of students, teachers, and citizens in general.

COORDINATED PLANNING WITH OTHER AGENCIES IS IMPORTANT: The Department of Education cannot, and should not, plan to create a comprehensive statewide telecommunications network by itself. Other state and local agencies and telecommunications resources within the state need to be included in the planning process.

INTERNAL AUTOMATION IS IMPORTANT TO CDE: The Department of Education needs to analyze whether it is currently organized and equipped to utilize telecommunications and technology most effectively. Some units or programs use telecommunications on a daily basis, while others are still dependent on typewriters and telephones. Also, a number of CDE staff have automation, data processing, technology, or telecommunications responsibilities, but there is a need for better focus and coordination of their efforts.

RECOMMENDATIONS

The Colorado Educational Telecommunications Network, as proposed, will not be a physical entity. Hence, a number of inter-related recommendations need to be achieved to attain network implementation. Some recommendations are more critical than others. For example, if the State Board of Education does not identify telecommunications as a high priority, Department staff will not be focused on that goal and foundation funding will be difficult to obtain.

All recommendations pertaining to a specific topic are contained in the Implementation Strategies Section of this Study. Background and explanatory information related to each recommendation will also be found within the appropriate Chapter in the Implementation Section.

All recommendations are listed below and are grouped into categories for ease of analysis:

STATE BOARD OF EDUCATION

The State Board of Education, as governing authority for the Department of Education, has broadly-based powers and responsibilities under state Statutes More importantly, the State Board exerts subtle influence upon local boards by endorsing concepts, identifying priorities, and taking stands on emerging trends and issues. For this reason, the Board's support will be crucial in implementing a statewide educational telecommunications network.

o The State Board of Education should announce that implementation of a statewide educational telecommunications network is its top priority for the next two years. Although the Board has many other potential priorities to consider, telecommunications provides the vehicle for delivering all types of instruction and information. Board actions regarding Department of Education budget requests, staff assignments, and grant awards should reflect this priority.

o The State Board of Education should create a new position, Director of Telecommunications, as a senior-level position within the CDE. This person should report to the Deputy Commissioner and be charged with coordinating all activities related to implementation of this Telecommunications Study.

o The State Board of Education should host a meeting of major Colorado corporations doing business in the telecommunications and technology field. Purpose of the meeting should be to introduce the business community to the Telecommunications Study and solicit specific ways in which they could be supportive.

o The State Board and Commissioner of Education should use the influence of their positions to tap funding from state and regional foundations. Foundation support can be one way to overcome the need for seeking large amounts of funding from state and federal sources.

o The State Board of Education should issue press releases concerning Board actions to their constituents in schools and libraries via electronic mail. Not only will this provide Board members with an effective communications vehicle, but will demonstrate the Board's commitment to a statewide educational telecommunications network.

o The State Board of Education should explore with the Attorney General's Office the legality of holding Rules hearings via tele-conferencing. For the present, that would mean interactive audio along with electronic mail or electronic blackboard, but video (either interactive or one-way) will be possible in the near future.

o The State Board of Education should establish a Telecommunications Implementation Council. This State Advisory Council should be widely representative of all key players in the Colorado educational telecommunications field. Membership should be composed of practitioners, administrators, and governing board members. This Council should examine policy issues related to successful implementation of the statewide educational telecommunications network and make recommendations to the State Board and Commissioner.

COLORADO DEPARTMENT OF EDUCATION:

The Commissioner of Education has specific powers and duties that are detailed in state Statutes. He is also able to utilize the influence of his office to cause a variety of actions to take place. To a lesser extent, CDE staff can use their credibility, field contacts, and expertise to encourage schools and libraries to focus on implementing the goals and objectives contained in this Study.

The credibility and expertise that make CDE staff effective in the field can be jeopardized if the Department is perceived by its constituents as being "behind the times". Also, CDE staff have a critical need to communicate with their various audiences in the field in the most efficient and cost effective manner. Hence, internal technology at CDE becomes a prime component in successful implementation of a statewide educational telecommunications network.

Administration:

o The Commissioner of Education should host a meeting of Chief State School Officers from western states interested in exploring formation of consortia for sharing educational and informational technology. Such benefits as group purchase discounts, reciprocity of programming, and access to highly technical assistance, can be outgrowths of such cooperation.

o The Commissioner, Deputy, and Assistant Commissioners of Education should use an internal electronic mail system for all internal correspondence and an electronic scheduling system for setting all internal meetings This practice will send a signal to staff and constituents that a commitment to technology exists at the highest level within the Department.

o The Commissioner of Education should announce that after a certain date (probably one to two years in the future) all general announcements from the Department will be made via electronic mail. As of that date, the weekly mailing to school districts should also be disseminated electronically. Large documents could be identified by title in the weekly electronic mailing and sent Book Rate on a weekly or bi-weekly basis.

o CDE should decide to use Easylink, currently in use by some CDE staff and some local schools, BOCES, libraries, and RLSS, or choose another electronic mail system. All CDE information should be accessible via one system--a system that will not penalize those in rural areas.

o CDE staff should be permitted to continue to access commercial or specialized electronic mail or bulletin boards in order to stay informed about national issues or to communicate with their peers in other state departments of education or state libraries. They should not have to make a decision between these national electronic mail systems and Easylink (or whatever system is chosen by CDE for general communication with the field).

o The CDE Executive Committee should examine how requests for assistance from the field are currently handled by CDE staff. The CDE Technology/Telecommunications Committee should be directed to determine whether an internal electronic mail and bulletin board system could provide the vehicle for assigning field requests for telecommunications/technology to the staff member or contractor best qualified to respond.

o CDE should develop an "Education Hotline" electronic bulletin board. This would contain the latest news from national, state, and local levels. It would promote use of CDE's electronic mail system by educators across the state.

o The State Library should develop an electronic "Hotline for Libraries" that would provide the latest news from local, state, and national levels. This would be particularly valuable to staff in small libraries who do not have access to professional library publications. It would also promote use of the CDE electronic mail system by librarians in the state.

o CDE should develop a cohesive, comprehensive, Department-wide ADP plan, which would be presented to the Colorado General Assembly for funding. Those state agencies that have taken such a course have been fairly successful in obtaining needed support.

Staffing:

o The CDE Executive Committee should consider whether aspects of consulting related to implementation to the Telecommunications Study can be accomplished better with internal staff or outside contractors. Factors to be considered include: level of specialized technical expertise required, length of time assistance will be needed, ability of CDE to obtain funding for additional staff, and cost effectiveness of both approaches.

o The CDE Director of Telecommunications should track emerging telecommunications technologies that might hold promise for schools or libraries. Also, some existing systems are not now cost effective, but will be

in the near future. Tracking of telecommunications should be accomplished by reading specialized professional publications and attending conferences or meetings on these topics.

o The Director of Telecommunications should serve on all proposed committees to provide continuity and prevent duplication or overlap.

o Opportunities must be provided, and funds appropriated, for CDE staff to gain proficiency in utilization of a variety of educational telecommunications technologies in order to make them more effective in the performance of their job responsibilities.

Internal Committees:

o The Commissioner of Education should establish a CDE Technology/Telecommunications Committee composed of the most technically qualified people within the Department, with representation from every Office. The Committee would consider technology/telecommunications problems within CDE; make recommendations regarding utilization of emerging technologies or the need for modifications in existing internal systems or equipment; and advise Offices, Units, and Program Managers regarding integration of technology and telecommunications into CDE programs. This Committee would also be charged with working with CDE staff to assure usability and compatibility of new systems with existing technologies.

o The CDE Technology/Telecommunications Committee should study the issue of costs related to changing from a paper to an automated communications system and report these findings to the CDE Executive Committee. Staff are concerned that savings in reduced paper transmission may not offset increased telecommunications costs. This may be true for the next few years, so additional monies may have to be made available to staff if they are to be expected to use the electronic mail and bulletin boards.

o The Commissioner of Education should create a CDE Users' Group, composed of staff who use technology on a daily basis. This Group would alert the CDE Technology/Telecommunications Committee about problems, concerns, and needs related to usefulness of existing CDE technology/telecommunications and identify areas needing study by the Technology/Telecommunications Committee.

o The Commissioner of Education should form a CDE Technology Policy Committee to provide a means of assuring focused direction in implementing internal automation, and to serve as a forum for consideration of policy implications regarding recommendations coming from the Users' Group and Technology Committee. Membership of the Committee should be equally divided between staff and senior administration (e.g., Unit Director or higher.)

LOCAL DECISION MAKERS:

Successful implementation of this Study will not occur unless decision makers at the local school and library level analyze the recommendations and determine how they can be utilized to assist in meeting local goals and

objectives. All recommendations made in this Study will not be relevant to any one group of local decision makers. It will be the responsibility of local boards and administrators to identify those recommendations that they can support and assist toward their achievement.

o Local school districts should examine the curricular content, instructional concepts, textbooks, and supplemental materials of distance learning courses. Some may not fit into their community's philosophy.

o Superintendents and principals need to consider all the implications connected with selection of instructional delivery systems. Cost is an important factor, but only one of many that should be studied in depth before a decision is made which could commit the district to a course of action for some time into the future.

o The Commissioner of Education should confer with school superintendents to clarify which of two conflicting perceptions regarding their support of educational telecommunications is valid. He should inform CDE staff of his findings.

o Colorado's Boards of Cooperative Educational Services can serve an important function by coordinating implementation of educational telecommunications on the multi-district level. BOCES should also consider projects that would lend themselves to multi-BOCES planning and implementation.

o Library boards, whether autonomous, part of a larger structure, or advisory, should take a leadership role in supporting resource sharing activities in their community.

o Librarians should be aware of the critical role they can play in assuring successful implementation of the statewide educational network. Directors and staff of academic, public, and school libraries should examine how they can contribute to resource sharing within their city, county, etc.

o Regional Library Service Systems should take a leadership role to assure that all types of librarians within their areas have an opportunity to discuss recommendations in this Study in light of local needs, goals, and objectives. This can best be accomplished by sponsorship of meetings, conferences, and seminars that will provide a forum for meaningful analysis of how libraries can contribute to implementation of a statewide educational telecommunications network.

FUNDING STRATEGIES:

A statewide educational telecommunications network will not happen without an infusion of funds. While state legislators are sensitive to the issue of educational and informational equity, the state's economy is in the doldrums. Therefore, the State Board and Commissioner should take a leadership role in seeking additional sources of funding for network implementation.

o The State Board of Education should host a meeting of major Colorado corporations doing business in the telecommunications and technology

field. Purpose of the meeting should be to introduce the business community to the Telecommunications Study and solicit specific ways in which they could be supportive. [Repeated from State Board of Education recommendations]

o The State Board and Commissioner of Education should use the influence of their positions to tap funding from state and regional foundations. Foundation support can be one way to overcome the need for seeking large amounts of funding from state and federal sources. [Repeated from State Board of Education recommendations]

o The Colorado education and library communities must present a unified plan to the General Assembly regarding funding for a statewide educational telecommunications network. Most legislators interviewed by the contractor were willing to consider requests for funding if—and only if—they were well thought out, cost effective, and represented the collective thinking of major participants.

o CDE should seek funding to assure continuation of KRMA's instructional programming. The amount required to continue KRMA's programming is miniscule when compared with the expenditures that would be needed to replicate KRMA if its service were allowed to lapse.

o CDE should seek funding to provide satellite access for small schools. These schools cannot assume the front-end costs connected with purchase and installation of a satellite dish, even though they could afford to absorb continuing expenses.

o The Commissioner of Education should earmark state capital outlays funds for FY'87, '88, and '89 toward bringing telecommunications access to all members of the CDE staff. All federal funds that can be expended for this purpose should be so designated.

o CDE should submit a proposal to the National Telecommunications Information Administration (NTIA) during the next Call for Proposals (Fall, 1986 to January 15, 1987) to seek funding for a major component of the statewide educational telecommunications network.

o CDE should consider its data transmission needs and those of local schools and libraries in light of cost savings that can be attained by using the state microwave system.

o If CDE, or a large number of local schools and libraries, wish to utilize the state microwave system for data transmission, consideration should be given to finding alternative systems to use when there are microwave outages.

o CDE's Director of Telecommunications should confer with the Director of the Division of Telecommunications to determine if a joint request for additional staff to service state microwave outages would make use of the backbone system more reliable for CDE, schools, and libraries.

o CDE should explore with the Attorney General's Office ways in which state-private sector programs can be established that do not violate the Constitutional prohibition against joint ventures. Such avenues as not-

for-profit corporations or demonstration projects are two possibilities that should be explored.

o CDE should seek funding to obtain satellite uplink capabilities for KRMA-TV. This will greatly increase their potential service area and assure better reception in mountainous parts of the state.

INSTRUCTIONAL DELIVERY:

The most exciting aspect about educational telecommunications is its ability to deliver needed instruction to geographically isolated students. But it can also be used to present specialized courses (e.g., Japanese) to students in densely populated areas. Educational decision makers need to analyze the broad range of courses available and select those most able to address local needs.

o CDE should assist school districts and libraries in developing telecommunications implementation plans. These plans should address strategies whereby local agencies will implement recommendations in the Telecommunications Study that meet local needs.

o The Director of Telecommunications should work with Colorado State University to clarify what role CSU could or should play in satellite transmission of instructional programming to Colorado's elementary and secondary schools. Decisions may be dependent on what role is delineated for CSU in the area of teacher education via telecommunications. Also, the Colorado Commission on Higher Education should be asked to clarify and expand on their identification of CSU as the telecommunications leader in higher education.

o CDE should explore with KRMA-TV the possibility of using early morning hours (midnight to 6:00 a.m.) for production and transmission of programs that could be recorded and used by schools and libraries at a later time.

o The Director of Telecommunications should explore with interested school districts whether a statewide educational telecommunications network could provide homebound educational services to students in small school districts. Large districts, that now provide visiting teachers to students who are temporarily homebound because of illness or injury, may also want to explore this alternative.

o Colorado educators should identify situations in which students could gain as much instructionally by using one of the excellent microcomputer or CD-ROM software packages to provide independent or small group study with minimal assistance from a teacher, aide, or adult volunteer.

o Small or rural elementary and middle schools in Colorado that cannot afford to hire specialized teachers should consider using microcomputer instruction for enrichment, supplemental, or remedial education. For example, software is available for such subject areas as: meteorology, geography, exploration, vocabulary building, remedial reading, etc.

o Special educators in Colorado should explore whether Colorado could replicate the TELEPAC project. This Oregon program used telecommunications to train parents of severely handicapped pre-school children.

o Both Maine and Minnesota have written good special education technology plans. The Maine document, which is especially well done, emphasizes the importance of planning. With such a good model available, Colorado special educators should consider adopting it rather than developing a Colorado plan.

o Colorado special educators should explore how technology's ability to permit the handicapped to "get out of their bodies" can be used to assist special education and increase the employability of the handicapped.

ACCESS TO RESOURCES:

Educators have always depended on learning resources to support and supplement what is taught in the classroom. This concept becomes more critical when the instructor is miles away and the local school, or even local community, does not possess the learning resources necessary to support distant curricula. A statewide eduational telecommunications network can provide the means of accessing a variety of materials from within the state and across the country.

o Colorado schools should explore the benefits that would accrue to their students by providing access to online information resources that are available from one of the national electronic databases.

o School administrators should make sure that their school districts are active members of Colorado's Regional Library Service Systems. Membership will provide access to library networking opportunities within their region.

o School districts should encourage their school library media specialists to stay informed about emerging trends and issues in library automation and networking on the regional, state, and national level. This knowledge will assist the school district in providing high quality learning resources to faculty and students.

o School administrators should assure that resources found on automated databases can be obtained. This means a commitment by school administrators and media specialists that interlibrary loan (ILL) will be utilized to obtain materials from other libraries. ILL requires staff time to request and return materials; as well as money for postage, phone calls, and packaging.

o Schools wishing to produce machine-readable records of their library holdings, should seek assistance from their Regional Library System, the Colorado State Library, or the Bibliographical Center for Research.

o School board members and administrators should take a leadership role in encouraging development of community resource plans. Such plans would include joint resource coordination among all libraries within a

city, county, or region.

TEACHER AND LIBRARIAN EDUCATION/ STAFF TRAINING:

Any new technology is only as effective as the people who use it on a day-to-day basis. Teacher training institutions must educate prospective teachers to use educational telecommunications effectively. Current teachers and administrators will need training to make educational telecommunications work in their districts.

o The State Board of Education and Commissioner should closely monitor recommendations being considered by the Colorado Commission on Higher Education's Teacher Education Access Committee to ascertain how telecommunications will be utilized as a vehicle for delivery of instruction to teachers.

o The State Board of Education and Commissioner should urge the Colorado Commission on Higher Education to clarify future roles of the University of Northern Colorado (designated as the lead institution for teacher training) and Colorado State University (identified as the telecommunications leader in higher education). Since CSU has satellite uplink capabilities, it will be important to explore ways in which they can plan together with UNC to deliver quality programs to Colorado educators.

o CDE should assure that teacher education institutions are training teachers to use educational telecommunications effectively. Specialized instruction in distance learning techniques should be included in the curriculum.

o Teachers need to be offered an inducement to take courses which retrain them to utilize telecommunciations and technology effectively. This recommendation may require a revision in certification Rules so that teachers
can be required to take some recertification credits in technology utilization.

o The CDE Certification Unit should determine whether any existing Rules need revision to permit teachers to obtain recertification credit from teleconferencing or other alternative delivery systems such as microcomputer software.

o CDE should develop electronic bulletin boards that provide information to teachers and librarians about certification, recertification, and continuing education opportunities.

o CDE should work with professional education and library association to identify methods of assisting administrators, board members, teachers, and librarians in overcoming psychological barriers to using technology and telecommunications effectively.

o The "each one teach one" philosophy has worked well in the arena of adult literacy. CDE should utilize this concept to build a coterie of technically savvy trainers in all areas of the state who could provide

assistance to others.

o The State Board of Education and Commissioner should reiterate their commitment to an accredited graduate school of librarianship in Colorado. Further, the Board and Commissioner should work with CCHE to ensure that plans for using telecommunications to deliver teacher education courses include library classes as well.

IMPLEMENTATION STRATEGIES:

All recommendations in this Study are aimed at implementation of a statewide educational telecommunications network, but some specialized activities must be undertaken if the network is to be successful. These activities can best be described as "marketing", a word that is usually applied in the business world. However, a statewide educational telecommunications network is an important new product—one that will require careful marketing to decision-makers and practitioners alike.

o CDE must sell the concept of a statewide educational telecommunications network to local school districts and local communities. A commercial television station should be approached to produce Public Service Announcements which could be distributed to all TV stations in the state as a means of informing citizens about educational telecommunications and technology.

o CDE should assist school districts and libraries in developing telecommunications implementation plans. These plans should address strategies whereby local agencies will implement recommendations in the Telecommunications Study that meet local needs. [Repeated from Instructional Delivery section.]

o The Director of Telecommunications should meet on a regular basis with key technical resource providers in the state. These would include: Division of ADP, Division of Telecommunications, KRMA-TV, CSU, and others. The purpose of these meetings would be to exchange information about new or emerging telecommunications technologies and to determine the appropriate role for each participant.

o CDE should submit proposals to the Colorado Broadcasters Association and the Colorado Cable Television Association requesting their assistance in implementing this Study. Assistance could take the form of technical advice to remote school districts, equipment repair, or provision of satellite downlink capabilities.

o CDE should work with professional education and library associations to inform them of this Study's recommendations, seek their concurrence, and solicit implementation suggestions. The Colorado Association of School Boards convention in December, 1986 will provide the CDE its first opportunity to inform decision makers of the Study's recommendations. A major session should be conducted and copies of the Study's Executive Summary should be printed in time for distribution at this conference.

o All CDE staff should be recruited to the task of marketing the

concept of using telecommunications to enhance the quality of instruction and information access. CDE Regional Field Coordinators and Accountability Consultants should be given special training and responsibility in this area.

o Boards of Cooperative Educational Services (BOCES) should form the basis for regional clusters that would assist schools in network implementation. Even though there is no legal relationship between the CDE and BOCES, the Special Education model of designating "administrative units" could be used. This format would permit larger school districts that wanted to assume their own responsibility to do so, but would permit small districts to utilize the BOCES for assistance in equipment purchase, staff training, etc..

o Regional Library Service Systems (RLSS) should form the basis for regional clusters that would assist libraries in network implementation. Current state Statutes permit such a partnership among local libraries, RLSS, and the State Library.

o BOCES and RLSS should plan together to develop an integrated process for providing access to instruction and information to all citizens of their region. School Boards should familiarize themselves with automation and networking plans already underway among academic and public libraries within their communities.

o CDE should publish a series of booklets providing guidance to schools and libraries concerning factors to consider before making technology/telecommunications decisions. In addition, the Department should develop a series of electronic bulletin boards that would contain similar, but more time-dependent, information. These bulletin boards would also provide a means for local agencies to compare notes, share ideas, and exchange information on implementation strategies.

o Installation, maintenance, and repair of equipment can be a real problem for schools and libraries in rural areas. The CDE, in cooperation with BOCES and RLSS, should explore creative approaches to identifying local expertise that may exist or could be developed within each region. Local phone companies, cable television stations, and other corporations could be approached to provide expertise in dealing with problems such as data transmission, poor TV reception, and equipment maintenance.

TIMELINE

Recommendations are spread across a five-year timeline. The purpose is to indicate when activities related to each recommendation should begin and end. Those recommendations that are multi-year are repeated for each year in which the activity should take place.

REMAINDER OF FISCAL YEAR '87 (10/15/86-6/30/87):

State Board of Education:

o The State Board of Education announces that implementation of a statewide educational telecommunications network is its top priority for the next two years.

o The State Board of Education creates a new position, Director of Telecommunications, as a senior-level position within the CDE.

o The State Board of Education hosts a meeting of major Colorado corporations doing business in the telecommunications and technology field.

o The State Board and Commissioner of Education use their influence to tap funding from state and regional foundations.

o The State Board of Education explores with the Attorney General's Office the legality of holding Rules hearings via tele-conferencing.

o The State Board of Education establishs a Telecommunications Implementation Council.

Colorado Department of Education:

o The Commissioner of Education hosts a meeting of Chief State School Officers from all western states interested in exploring formation of consortia for sharing educational and informational technology.

o CDE's Executive Committee examines how requests for assistance from the field are currently handled by CDE staff and directs the Technology/Telecommunications Committee to determine whether an internal electronic mail and bulletin board system could provide assistance.

o CDE's Executive Committee considers whether aspects of consulting related to implementation to the Telecommunications Study can be accomplished better with internal staff or outside contractors.

o CDE decides to use Easylink or chooses another electronic mail system.

o CDE develops two electronic bulletin boards: "Education Hotline" and "Hotline for Libraries".

o The Commissioner of Education establishes a CDE Technology/Telecommunications Committee composed of the most technically qualified people from each Office in the Department.
o The Commissioner of Education creates a CDE Users' Group, composed of staff who use technology on a daily basis.

o The Commissioner of Education forms a CDE Technology Policy Committee to assure focused direction in implementing internal automation, and to serve as a forum for consideration of policy implications regarding recommendations coming from the Users' Group and Technology Committee.

Local Decision-Makers:

o School districts examine the curricular content, etc., of distance learning courses to determine if they fit community philosophies.

o Superintendents and principals consider all the implications related to selection of instructional delivery systems.

o The Commissioner of Education confers with school superintendents to clarify conflicting perceptions concerning their support for educational technology and telecommunications.

o BOCES consider projects that would lend themselves to multi-BOCES planning and implementation.

o Library boards take a leadership role in support of resource sharing in their communities.

o Directors and staff of academic, public, and school libraries examine how they can contribute to resource sharing within their city, county, etc.

o RLSS take a leadership role to assure that all types of libraries in their area discuss recommendations in this Study in light of local needs, goals, and objectives.

Funding Strategies:

o The State Board of Education approves a budget request to seek satellite access funding for small schools.

o The Colorado education and library communities present a unified plan to the General Assembly regarding funding for a statewide educational telecommunications network.

o CDE seeks funding to assure continuation of KRMA's instructional programming. [May be deferred until FY'88 budget request depending on action by Denver Board of Education.]

o CDE seeks funding to provide satellite access to small schools.

o The Commissioner of Education earmarks state capital outlays funds

toward bringing telecommunications access to all members of the CDE staff. All federal funds that can be expended for this purpose should be so designated.

o CDE submits a proposal to the National Telecommunications Information Administration (NTIA) to seek funding for a major component of the statewide educational telecommunications network.
o CDE explores with the Attorney General's Office ways in which state-private sector programs can be established that do not violate the Constitutional prohibition against joint ventures.

Instructional Delivery:

o Local school districts examine the curricular content, instructional concepts, textbooks, and supplemental materials of distance learning courses to assure that they fit the community's philosophies.

o Colorado educators identify situations in which students could gain as much instructionally by using one of the excellent microcomputer or CD-ROM software packages to provide independent or small group study with minimal assistance from a teacher, aide, or adult volunteer.

o Small or rural elementary and middle schools in Colorado that cannot afford to hire specialized teachers consider using microcomputer instruction for enrichment, supplemental, or remedial education.

o Special educators in Colorado explore whether Colorado could replicate the TELEPAC project.

o Colorado special educators consider whether to adopt the Maine or Minnesota special education technology plans rather than developing a Colorado plan.

o Colorado special educators explore how technology can be utilized to help the handicapped "get out of their bodies".

Access to Resources:

o Colorado schools explore the benefits that would accrue to their students by providing access to online information resources that are available from one of the national electronic databases.

o School administrators assure that their school districts are active members of Colorado's Regional Library Service Systems.

o School administrators encourage their school library media specialists to stay informed about emerging trends and issues in library automation and networking on the regional, state, and national level.

o School administrators assure that resources found on automated databases can be obtained.

o Schools seek assistance from RLSS, CSL, or BCR regarding putting their library holdings in machine-readable form.

o School board members and administrators encourage development of community resource plans.

Teacher and Librarian Education/ Staff Training:

o The State Board of Education and Commissioner monitor recommendations being considered by the CCHE Teacher Education Access Committee to ascertain how telecommunications will be utilized as a vehicle for delivery of instruction to teachers.

o The State Board of Education and Commissioner urge the Colorado Commission on Higher Education to clarify future roles of the University of Northern Colorado and Colorado State University as they relate to delivery of teacher certification and recertification programs.

o CDE assures that teacher training institutions are training teachers to use educational telecommunications effectively, including distance learning techniques.

o Teachers are offered an inducement to take courses which retrain them to utilize telecommunciations and technology effectively.

o CDE's Certification Unit determines whether any existing Rules need revision to permit teachers to obtain recertification credit from teleconferencing or other alternative delivery systems.

o CDE develops electronic bulletin boards that provide information to teachers and librarians about certification, recertification, and continuing education opportunities.

o CDE works with professional education and library association to identify methods of assisting administrators, board members, teachers, and librarians in overcoming psychological barriers to using technology and telecommunications effectively.

o CDE utilizes the "each one teach one" concept to build a coterie of technically savvy trainers in all areas of the state who could provide assistance to others.

o The State Board and Commissioner reiterate their commitment to an accredited graduate library school in Colorado.

Implementation Strategies:

o CDE begins a program to sell the concept of a statewide educational telecommunications network to local school districts and local communities.

o CDE contacts a commercial TV station about developing a series of PSA's to highlight how educational telecommunications can meet student needs.

o CDE submits proposals to the Colorado Broadcasters Association and the Colorado Cable Television Association requesting their assistance in implementing this Study.

o CDE works with professional education and library associations to inform them of this Study's recommendations, seek their concurrence, and solicit implementation suggestions.

o CDE conducts a major session at the 1986 CASB convention and distributes copies of this Study.

o All CDE staff are recruited to the task of marketing the concept of using telecommunications to enhance the quality of instruction and information access.

o CDE Regional Field Coordinators and Accountability Consultants are given special training and responsibility in this area.

o Boards of Cooperative Educational Services (BOCES) are designated by CDE as the basis for regional clusters that would assist schools in network implementation.

o Regional Library Service Systems (RLSS) are designated by CDE as the basis for regional clusters that would assist libraries with network implementation.

o BOCES and RLSS begin planning together to develop an integrated process for providing access to instruction and information to all citizens of their region.

o CDE begins publication of a series of booklets providing guidance to schools and libraries concerning factors to consider before making technology/telecommunications decisions.

o CDE begins development of a series of electronic bulletin boards that would contain similar, but more time-dependent, information and an opportunity for school and library people to exchange ideas and strategies.

o The CDE, in cooperation with BOCES and RLSS, begins exploration of creative approaches to identifying local expertise that may exist or could be developed within each region.

FISCAL YEAR '88 (7/1/87-6/30/88):

State Board of Education:

o The State Board of Education issues press releases concerning Board actions to their constituents in schools and libraries via electronic mail.

o The State Board of Education approves a budget request to implement major components of this Study.

Colorado Department of Education:

o The Commissioner, Deputy, and Assistant Commissioners of Education announce that they will use an internal electronic mail system for all internal correspondence and an electronic scheduling system for setting all internal meetings.

o The Commissioner of Education announces that after a certain date all general announcements from the Department will be made via electronic mail.

o CDE develops a cohesive, comprehensive, Department-wide ADP plan, which would be presented to the Colorado General Assembly for funding.

o CDE's Director of Telecommunications tracks emerging telecommunications technologies that might hold promise for education or libraries.

o CDE's Technology/Telecommunications Committee studies the issue of costs related to changing from a paper to an automated communications system and report these findings to the CDE Executive Committee.

Local Decision-Makers:

o School districts examine the curricular content, etc., of distance learning courses to determine if they fit community philosophies.

o Superintendents and principals consider all the implications related to selection of instructional delivery systems.

o BOCES consider projects that would lend themselves to multi-BOCES planning and implementation.

o Library boards take a leadership role in support of resource sharing in their communities.

o Directors and staff of academic, public, and school libraries examine how they can contribute to resource sharing within their city, county, etc.

o RLSS take a leadership role to assure that all types of libraries in their area discuss recommendations in this Study in light of local needs, goals, and objectives.

Funding Strategies:

o The Colorado education and library communities present a unified plan to the General Assembly regarding funding for a statewide educational telecommunications network.

o The Commissioner of Education earmarks state capital outlays funds toward bringing telecommunications access to all CDE staff. All federal funds that can be expended for this purpose should be so designated.

o CDE continues explorations with the Attorney General's Office regarding

ways in which state-private sector programs can be established that do not violate the Constitutional prohibition against joint ventures.

o CDE seeks funding for implementation of major components of the educational telecommunications network.

o CDE seeks funding to assure continuation of KRMA's instructional programming. [If deferred from FY'88 budget request.]

o The Department of Education seeks funding to obtain satellite uplink capabilities for KRMA-TV.

o CDE explores with KRMA-TV the possibility of using early morning hours for production and transmission of programs that could be recorded and used by schools and libraries.

Instructional Delivery:

o CDE assists school districts and libraries in developing telecommunications implementation plans.

o Local school districts examine the curricular content, instructional concepts, textbooks, and supplemental materials of distance learning courses to assure that they fit the community's philosophies.

o CDE's Director of Telecommunications works with Colorado State University to clarify what role it could play in transmission of instructional programming to Colorado's elementary and secondary schools.

o CDE's Director of Telecommunications explores with interested school districts whether a statewide educational telecommunications network could provide homebound educational services to students in small school districts.

o Colorado educators identify situations in which students could gain as much instructionally by using one of the excellent microcomputer or CD-ROM software packages to provide independent or small group study with minimal assistance from a teacher, aide, or adult volunteer.

o Small or rural elementary and middle schools in Colorado that cannot afford to hire specialized teachers consider using microcomputer instruction for enrichment, supplemental, or remedial education.

o Special educators in Colorado explore whether Colorado could replicate the TELEPAC project.

o Colorado special educators consider whether to adopt the Maine or Minnesota special education technology plans rather than developing a Colorado plan.

o Colorado special educators explore how technology can be utilized to help the handicapped "get out of their bodies".

Access to Resources:

o Colorado schools explore the benefits that would accrue to their students by providing access to online information resources that are available from one of the national electronic databases.

o School administrators assure that their school districts are active members of Colorado's Regional Library Service Systems.

o School administrators encourage their school library media specialists to stay informed about emerging trends and issues in library automation and networking on the regional, state, and national level.

o School administrators assure that resources found on automated databases can be obtained.

o Schools seek assistance from RLSS, CSL, or BCR regarding putting their library holdings in machine-readable form.

o School board members and administrators encourage development of community resource plans.

Teacher and Librarian Education/ Staff Training:

o The State Board of Education and Commissioner continue to monitor recommendations being considered by the CCHE Teacher Education Access Committee to ascertain how telecommunications will be utilized as a vehicle for delivery of instruction to teachers.

o The State Board of Education and Commissioner urge the Colorado Commission on Higher Education to clarify future roles of the University of Northern Colorado and Colorado State University as they relate to delivery of teacher certification and recertification programs.

o CDE assures that teacher training institutions are training teachers to use educational telecommunications effectively, including distance learning techniques.

o Teachers are offered an inducement to take courses which retrain them to utilize telecommunciations and technology effectively.

o CDE's Certification Unit determines whether any existing Rules need revision to permit teachers to obtain recertification credit from teleconferencing or other alternative delivery systems.

o CDE develops electronic bulletin boards that provide information to teachers and librarians about certification, recertification, and continuing education opportunities.

o CDE continues to work with professional education and library association to identify methods of assisting administrators, board members, teachers, and librarians in overcoming psychological barriers to using technology and telecommunications effectively.

o CDE utilizes the "each one teach one" concept to build a coterie of technically savvy trainers in all areas of the state who could provide assistance to others.

o The State Board and Commissioner reiterate their commitment to an accredited graduate library school in Colorado.

Implementation Strategies:

o CDE continues its program of selling the concept of a statewide educational telecommunications network to local school districts and local communities.

o CDE works with a commercial TV station on development of a series of PSA's to highlight how educational telecommunications can meet student needs.

o CDE works with to the Colorado Broadcasters Association and the Colorado Cable Television Association to obtain assistance in in implementing this Study.

o CDE continues to work with professional education and library associations to inform them of this Study's recommendations, seek their concurrence, and solicit implementation suggestions.

o CDE staff support is continuously recruited to the task of marketing the concept of using telecommunications to enhance the quality of instruction and information access.

o CDE Regional Field Coordinators and Accountability Consultants are given special training and responsibility in marketing telecommunications to enhance the quality of instruction.

o Boards of Cooperative Educational Services (BOCES) work to establish regional clusters that would assist schools in network implementation.

o Regional Library Service Systems (RLSS) work to establish regional clusters that would assist libraries with network implementation.

o BOCES and RLSS continue to plan together to develop an integrated process for providing access to instruction and information to all citizens of their region.

o CDE continues publication of a series of booklets providing guidance to schools and libraries concerning factors to consider before making technology/telecommunications decisions.

o CDE continues development of a series of electronic bulletin boards that would contain similar, but more time-dependent, information and an opportunity for school and library people to exchange ideas and strategies.

o The CDE, in cooperation with BOCES and RLSS, continues exploration of creative approaches to identifying local expertise that may exist or could be developed within each region.

o CDE's Director of Telecommunications meets on a regular basis with key technical resource providers in the state.

FISCAL YEAR '89 (7/1/88-6/30/89):

State Board of Education:

o The State Board of Education approves a budget request to implement further components of this Study.

Colorado Department of Education:

o CDE's Director of Telecommunications continues to track emerging telecommunications technologies that might hold promise for education or libraries.

Local Decision-Makers:

o School districts continue to examine the curricular content, etc., of distance learning courses to determine if they fit community philosophies.

o Superintendents and principals continue to consider all the implications related to selection of instructional delivery systems.

o BOCES continue to consider projects that would lend themselves to multi-BOCES planning and implementation.

o Library boards continue to take a leadership role in support of resource sharing in their communities.

o Directors and staff of academic, public, and school libraries continue to examine how they can contribute to resource sharing within their city, county, etc.

Funding Strategies:

o The Colorado education and library communities present a unified plan to the General Assembly regarding funding for a statewide educational telecommunications network.

o The Commissioner of Education earmarks state capital outlays funds toward bringing telecommunications access to all CDE staff. All federal funds that can be expended for this purpose should be so designated.

o CDE seeks funding for implementation of additional components of the educational telecommunications network.

Instructional Delivery:

o CDE assists school districts and libraries in developing telecommunications implementation plans.

o Local school districts continue to examine the curricular content, instructional concepts, textbooks, and supplemental materials of distance learning courses to assure that they fit the community's philosophies.

o CDE continues to work with professional education and library association to identify methods of assisting administrators, board members, teachers, and librarians in overcoming psychological barriers to using technology and telecommunications effectively.

Teacher and Librarian Education/ Staff Training:

o CDE continues to utilize the "each one teach one" concept to build a coterie of technically savvy trainers in all areas of the state who could provide assistance to others.

o CDE continues to work with professional education and library association to identify methods of assisting administrators, board members, teachers, and librarians in overcoming psychological barriers to using technology and telecommunications effectively.

Implementation Strategies:

o CDE's Director of Telecommunications continues to meet on a regular basis with key technical resource providers in the state.

FISCAL YEARS AFTER FY'89:

o The State Board of Education continues to approve budget requests for additional components of the educational telecommunications network.
o CDE's Director of Telecommunications continues to track emerging telecommunications technologies that might hold promise for education or libraries.

o CDE continues to seek funding for additional components of the educational telecommunications network.

o CDE continues to assist school districts and libraries in developing telecommunications implementation plans.

o The Colorado education and library communities continue to present a unified plan to the General Assembly regarding funding for a statewide educational telecommunications network.

o CDE continues to work with professional education and library associations to identify methods of assisting administrators, board members,

teachers, and librarians in overcoming psychological barriers to using technology and telecommunications effectively.

o CDE continues to utilize the "each one teach one" concept to build a coterie of technically savvy trainers in all areas of the state who could provide assistance to others.

o CDE's Director of Telecommunications continues to meet on a regular basis with key technical resource providers in the state.

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INTRODUCTION

This Study examines ways in which telecommunications can be used by school districts, libraries, and the Colorado Department of Education. Its goal is not to recommend that Colorado's schools and libraries **should use** technology or telecommunications. Rather, its purpose is to identify how telecommunications **can be used** to solve existing problems or to provide more efficient and cost-effective services to all Coloradans.

The Colorado Educational Telecommunications Network, as proposed, will not be a physical entity. The proposed network is an **operating philosophy** and an **overall planning strategy.** This Study does not recommend development of a statewide technological entity to meet instructional and informational needs. The network, as conceived, is the sum of all the parts of a carefully organized planning effort. The result will be a cohesive network strategy, not a network infrastructure.

Recommendations contained in this Study propose development of a "statewide educational telecommunications network". Therefore, it is important to understand the context in which the terms, "educational" and "telecommunications" are used.

"Education", as used in this Study, should be interpreted to mean life-long learning. If formalized instruction is intended, the term "instructional telecommunications" is used. Instruction does not apply solely to K-12 students, since teacher education, special education for pre-schoolers, and adult basic education or high school completion are important components of instructional telecommunications.

The term "informational telecommunications" is used herein to describe automated systems which provide access to online informational databases. These databases may be available from commercial vendors or could be locally developed.

Although it is difficult to separate "telecommunications" from "technology", this Study interprets "telecommunications" as the **vehicle** by which "technology" is delivered from one point to another. References are made to a variety of technologies as they related to administrative, instructional, and informational telecommunications.

A number of inter-related recommendations need to be achieved to attain network implementation. Some recommendations are more critical than others. For example, if the State Board of Education does not identify telecommunications as a high priority and does not appoint someone at the Department of Education to coordinate network development, chances of success will be greatly reduced.

All recommendations are contained in the Executive Summary. In this document, recommendations are grouped, along with background and explanatory information, under the same topical headings used in the Recommendations section of the Executive Summary.

HISTORY OF TELECOMMUNICATIONS STUDIES IN COLORADO

OVERVIEW:

The State of Colorado has long sought a means of utilizing telecommunications for educational purposes. Throughout the past 30 years, the Department of Education has been represented on every major interdepartmental commission or task force created for this purpose. Beginning in 1956, the State of Colorado has developed a microwave network which reaches virtually every area in the state. Although the network was originally intended for law enforcement and public safety agencies, the Colorado educational and library communities have investigated ways to harness this resource.

EDUCATIONAL TELEVISION:

Educators saw the instructional potential for television. Beginning in the early 1960's an Educational Television Commission was formed to study the feasibility of developing a statewide ETV capability to serve elementary, secondary, and higher education. A Report issued by the ETV Commission in 1962 stated: "Now is the time to start using television in education." Research leading to the report found that K-12 educators felt ETV could help them meet the educational needs of their students, while junior college and university educators pointed out the advantage of offering courses that could not normally be taught because of class size or budgetary restrictions. The 1962 ETV Report was followed by a five-year plan for implementation which was issued in 1964.

LIBRARY AUTOMATION:

Librarians saw the advent of technology as a means of gaining better control over the mass of information and the labor intensive nature of managing such information. Beginning in the mid-1960's librarians began to explore how computers could be used in libraries, but they were stymied by the lack of national or international standards regarding how bibliographic information should be stored and retrieved. In 1964, the Library of Congress began a series of studies to resolve this issue. The resulting standard, called MARC (for Machine Readable Cataloging), became available to the library community in 1968.

Introduction of the MARC standard meant that several libraries' holdings could be consolidated into one online database. Thus began the development of online library networks. One of the first such networks was the Ohio College Library Center (OCLC), which was chartered in 1967 and began operation in 1970. OCLC expanded through the intervening years into the nation's largest online database. The acronym was re-defined to stand for the Online Computer Library Center, signifying its emergence as a national and international bibliographic utility. Currently, the OCLC database contains over 14 million titles as well as the holding codes of thousands of libraries across the U.S. and in many foreign countries.

STATEWIDE EDUCATIONAL TELECOMMUNICATIONS STUDY:

The most comprehensive study directed at identifying how K-12 and higher education could tap existing telecommunications technology was the Telecommunications Report of January, 1973. Many of the recommendations contained in that report are still valid; e.g., utilize the state microwave system to reduce instructional delivery costs and increase educational opportunity in rural areas. The cost of implementing the Report's recommendations was in excess of $2 million. The Colorado General Assembly rejected this funding package, thereby indirectly rejecting the proposed educational network.

A great deal has happened in the intervening years. Some significant events have been: expansion of the technology options available; greater reliance of public agencies on technology for instructional, informational, and administrative purposes; and increased costs for telecommunications caused by deregulation. However, the need identified in the 1960's and 70's remains remarkably constant: cost-effective delivery of quality instructional programs and informational resources to all areas of the state. The proposed use of technology, especially telecommunications, for this purpose appears to be even more valid now than it was 25 years ago.

EDUCATIONAL SATELLITE PROGRAMMING:

The Rocky Mountain States Satellite Technology Demonstration Project transmitted educational programs during the 1974-75 school year using NASA's ATS-6 satellite. The program included three instructional series prepared especially for the project, plus transmission of over 400 educational films and video tapes, which were intended to form a resource base for future curriculum enrichment.

Teacher evaluations of the project were mixed. Problems arose because the original programming transmissions tended to force class schedules to conform with them. Also, questions arose about the cost effectiveness of transmitting a large number of films via satellite when they could have been copied onto video tapes and mailed to each school at a much lower cost.

DELIVERING LIBRARY RESOURCES VIA TELEFACSIMILE:

The University of Denver's Graduate School of Librarianship was one of eight agencies to receive a grant administered by the Office of Telecommunications Policy, Office of the Assistant Secretary of Health, Education, and Welfare for Planning and Evaluation. DU's project, which began in 1973 was designed to test the feasibility and cost effectiveness of using telefacsimile and slow scan TV for document delivery to rural public libraries. It was the only one of the national projects to study library telecommunications issues. The Colorado State Library and the Durango Public Library were involved in this project, entitled TALINET (Telefax Library Information Network).

After an extensive evaluation, the project's conclusions were: 1.) patrons of small rural public libraries had sophisticated information needs which could benefit from telefacsimile delivery of documents from distant sites, 2.) telefacsimile could be utilized to deliver library materials from one site to another, 3.) the whole procedure was not cost effective at that time or at least not for small, rural public libraries. (Average costs to transmit a 6 page document ranged from $13.56 to $23.78), and 4.) slow scan television, as used in the project, did not adapt itself well to library purposes.

LIBRARY NETWORK PLANNING:

Individual libraries in Colorado began moving toward automation during the late 1960's and early 1970's, along with the national trend to store and retrieve records online. The Bibliographical Center for Research (BCR) moved from being the repository of a large card file of Mountain Plains library holdings to a broker of library automation services during this same period. With the advent of the MARC standard for storing bibliographic data, more and more Colorado libraries saw the resource sharing advantages to be gained from putting their records in machine-readable form.

Beginning in 1978, concentrated activities began toward development of a statewide library network based on the growing number of libraries whose records could be combined into an online database (or databases). Another impetus to network planning was announcement that the Library Services and Construction Act (LSCA) legislation might not be reauthorized. Colorado libraries and the State Library had depended on LSCA funding to provide seed-money for innovative projects and programs. Therefore, a decision was made to earmark LSCA monies for 1979, '80, and '81 to fund projects that would form the nucleus of a statewide library network.

GOVERNOR'S COMMISSIONS ON PUBLIC BROADCASTING AND TELECOMMUNICATIONS:

Two gubernatorial commissions addressed public broadcasting and telecommunications issues. The First Report of the Governor's Commission on Public Broadcasting was issued in 1980. Recommendations from that report included: extension of "first services" to areas of the state not covered, improvement of existing services, and strengthening of production capabilities to provide locally originated programming. A key recommendation of that commission was the requirement to: "define clearly the State role in the development of a public telecommunications system which meets the needs of its citizens." Toward this purpose, a second gubernatorial commission formed in 1980: on public telecommunications.

A lack of funding prevented the final report of the Governor's Commission on Public Telecommunications from being published. However, an Executive Summary and Final Contractor's Report identify the continued need for a cohesive statewide plan for utilizing existing telecommunications resources and planning for coordinated future growth. Some positive outcomes of the commission were: agreed upon definitions of commonly used technology terms; agreement on a continuing process for integrating the telecommuni-

cations planning process into state and local decision-making; and the need for a statewide plan for public telecommunications.

INVESTIGATING INTERACTIVE VIDEO FOR INSTRUCTION:

The Northeast Colorado Board of Cooperative Educational Services (NECBOCES) received an Elementary and Secondary Education Act (ESEA), Title IV-C Planning Grant in 1981. Purpose of the project was to investigate how interactive video classes in mathematics, foreign languages, and advanced science could be provided to its 17 member school districts. An Implementation Grant was not funded at the conclusion of the Planning Grant, so no further work has been done. However, the Evaluation Report contains several significant recommendations and findings. A recent interview with Willard E. Holthus, Executive Director of NECBOCES, revealed that the need for instruction in math, science, and foreign languages is just as pressing now as it was five years ago. The sad thing is that the need is still unmet, and the school districts continue to search for solutions to the gaps in their curricular offerings.

COLORADO DEPARTMENT OF ADMINISTRATION PLANNING:

The Department of Administration has provided overall leadership and technical assistance to other state agencies in developing automation and data processing capabilities. Advice from State ADP, a Division within the Department of Administration, has taken two forms: consultative assistance regarding initial installation of automation, and performance evaluations of automation activities. In addition, State ADP has issued a series of Master Plans detailing existing automation inventories and suggesting future technological and budgetary requirements for the state.

The Division of Communications, also within the Department of Administration, has provided technical assistance to state agencies in analyzing potential uses of the statewide microwave network for purposes other than law enforcement and public safety. Their 1982 Long Range Plan defines the COLONET concept, which provides the State with an alternative telephone service for voice and data transmission. Completion of the microwave system, envisioned in the 1982 plan, has been slowed by funding difficulties, but the 1986 Long Range Plan indicates some progress. The Division has been more successful in upgrading existing links to meet the increased demands of technology.

COLORADO COMMISSION ON HIGHER EDUCATION:

CCHE and individual institutions of higher education have worked closely with State ADP to develop means of dealing with their mass of paperwork. While modifications and enhancements could further increase efficiency and effectiveness, this need has been met to some degree. The goal of utilizing technology to meet higher education instructional needs has been studied for some time. For example, the Association of State Institutions of Higher Education in Colorado proposed ways, in 1964, to enhance instruction by using ETV. Most of the goals regarding instructional technology and

higher education remain to be met.

COLORADO DEPARTMENT OF EDUCATION:

CDE has conducted a series of studies in the area of technology and its appropriate use by school districts and libraries. These analyses of existing and potential uses of technology have been conducted by internal committees and external task forces. The purposes of these various groups have ranged from data collection to electronic mail; from computer literacy to library networking. Although recommendations from these groups have been considered and often implemented by CDE and its clients, there has not been a comprehensive study of how all the components of the Department of Education could utilize technology most effectively to deliver equality of educational opportunity and equality of informational access to all Coloradans.

The Colorado State Library, an Office within the Department of Education, initiated several activities to address the need for statewide planning for library automation. In 1980 the State Board of Education appointed a Network Development Committee (NDC) charged with planning and designing a statewide network for resource sharing among libraries. The NDC made several recommendations, including appointment of a Network Implementation Council (NIC) to develop implementation strategies for the emerging library network. As a component of the NIC report, a contract was let with the Denver Research Institute to conduct a telecommunications study for Colorado libraries. The final report from this committee has not yet been made.

RECENT CDE ACTIVITIES:

In January, 1986, the Department of Education hosted a meeting of persons involved with the use of technology in education. The following issues were explored: 1.) How can all the existing pieces be brought together? 2.) How can future expansion of technology in education build on what has been accomplished without duplication of efforts? 3.) How can Colorado educators learn from technology projects in other states? 4.) How can the private sector become involved to assist the State in achieving its goals?

The State Board of Education approved a contract in February, 1986, calling for development of a telecommunications plan. Its purpose was to propose ways in which the Colorado Department of Education could provide leadership in implementing a statewide educational telecommunications network. This Telecommunications Study is the result of that contract.

CURRENT TELECOMMUNICATIONS PROJECTS IN COLORADO

SCHOOLS:

Very little is happening at the present time in Colorado's schools that could be identified specifically as educational telecommunications. Certainly, there is a great deal of microcomputer use in instructional areas. However, if telecommunications is seen as the vehicle that permits transmission of data, audio, and video, Colorado is far behind other states.

Two schools in the Montrose School District (Olathe and Montrose High) used a satellite Spanish program from Utah during the past school year. The Olathe school had participated in a pilot project from Oklahoma State University during the 1984-85 school year, but no Colorado schools used OSU's German by Satellite course during the 1985-86 year.

It should not be forgotten that 121 school districts in the state currently receive instructional television programs from KRMA-TV in Denver, and another 58 districts are served by KTSC-TV in Pueblo. This public television programming is aimed at all grade levels, while the satellite video courses from Utah, Texas, and Oklahoma are intended primarily for gifted high school students.

Two school districts on the West Slope are participating in the MARMOT library consortium. This project, which is in the implementation phase, will link the holdings of 18 libraries in western Colorado. When the project is operational in early 1987, participants will have online access to the holdings of most major libraries on the West Slope, and will be able tie into the emerging Colorado Library Network.

LIBRARIES:

Telecommunications activities in Colorado's libraries have been studied in depth by Kenneth R. Harmon of the Denver Research Institute under a contract from the Colorado State Library. Persons desiring more information about library telecommunications should request a copy of the Harmon study from the Colorado State Library:

Colorado Department of Education. Study for Colorado Libraries. Prepared by Kenneth R. Harmon for the Colorado State Library. Denver: The Department, 1986.

HIGHER EDUCATION:

The Colorado Commission on Higher Education has assigned a leadership role to Colorado State University in the area of telecommunications for higher education institutions in the state. In testimony to the House Education Committee of the Colorado General Assembly, CSU representatives stated: "CSU is a recognized leader in developing programs that utilize technology, particularly in the area of telecommunications."

CSU has been providing videotapes of selected classes to business and industry in Colorado since 1967. In addition, they are a member of the National Technological University (NTU), a consortium of 27 universities nationwide that exchange educational programming. In the fall of 1985, CSU established a satellite uplink to participate with other NTU institutions in broadcasting via this technology.

CSU, in collaboration with the Colorado State Library, was one of four states to receive a grant from the Kellogg Foundation "to develop a research and pilot program to extend higher education and state library resources to rural communities by means of technology."

Despite these activities, CSU currently has no plans for direct provision of courses to Colorado school districts by means of educational technology. They expressed an interest and willingness to work with K-12 educators in developing programs that would meet the needs of rural schools. But, they have no current advisory committee or other group identified to provide input in this area.

The Colorado Commission on Higher Education has appointed a Teacher Education Access Committee to address how teachers can access graduate and recertification coursework. The report is to consider costs, models, delivery systems, and utilization of the telecommunications expertise available from Colorado State University. The Access Committee plans to make its report to CCHE by December 1986.

The University of Northern Colorado operates public radio station KUNC. They have already established an uplink to the state microwave system as part of the Colorado Radio Information Service (CRIS) program. An interview with the station manager indicated a high degree of interest in working with CDE on ways in which the facilities of KUNC could support instructional audio programming.

The University of Colorado at Colorado Springs has applied to the Federal Communications Commission for an Instructional Television Fixed Signal (ITFS) channel. Pikes Peak Community College and several school districts in the Colorado Springs area have expressed an interest in developing cooperative programming for use on this system. However, the FCC has not yet notified UCCS of approval for the channel.

The University of Southern Colorado operates public television station KTSC. This station provides instructional programming to 58 school districts in the southern and southeastern part of the state.

Colorado Mountain College (CMC) has undertaken an ambitious program, under its Interim President, to seek private sector funding of some pilot programs. Proposed activities would be directed toward addressing the cost problems arising from providing instruction of several campuses spread over a large area. The results of this undertaking should be watched carefully by the Colorado education community—both K-12 and higher education—for models that could be replicated elsewhere in the state.

Six West Slope college and community college libraries are participants in the MARMOT project, described above.

OTHER STATE AGENCIES:

A number of state agencies have written Information Management Systems (IMS) plans. These documents have attempted to pull together the wide variety of computer programs that exist within each state agency. Also, duplicate data collection efforts have been identified and plans made for orderly consolidation. The Departments of Natural Resources and Transportation were identified as agencies that have developed exemplary IMS plans. The state microwave system is being gradually upgraded and further appropriations will be sought by the Department of Administration to move the network to digital equipment.

There appears to be a greater awareness on the part of the Divisions of ADP and Telecommunications that they need to provide technical assistance to other state agencies. That should help the Department of Education in considering various technology and telecommunications questions that will arise from this Telecommunications Study. They have already pledged their interest and support in connection with implementation of recommendations contained in this Study.

OPTIONS CONSIDERED

OVERVIEW:

In some areas of this Study, the issues were so straightforward that few options could be considered. For example, the lack of massive amounts of state and federal funds preclude consideration of a large, equipment-oriented statewide network. Instead, the contractor is recommending a system that builds on existing programs in Colorado and other states, with new development occurring only as gaps are identified.

Other issues are not as clearly delineated. In those areas, the Department and State Board of Education need to give thought to various options that are available, consider the criteria for evaluating options, and decide which courses of action best meet the needs of Colorado's schools and libraries. The following options and criteria are suggested for further study:

APPROPRIATE ROLE FOR THE DEPARTMENT OF EDUCATION: Colorado has a strong historical commitment to local autonomy. This philosophy has usually been translated into a "consultative" or "advisory" role for the CDE. However, most persons interviewed for this Study expressed a hope that the Department would exert strong leadership in developing plans for a statewide educational telecommunications network.

This leadership role should be undertaken even though some educators or librarians accuse CDE of trying to impose a "top-down" system on them. The consensus of opinion was that the Colorado Department of Education should exert strong leadership in direct-ing development of a statewide network for educational and informational telecommunications. CDE should write the agenda for how schools and libraries can utilize this resource effectively. It will be the responsibility of local boards and administrators to pick and chose those activities that best fit their needs.

Criteria for Decision-Making: The Commissioner and State Board need to determine how this call for strong leadership can be addressed without appearing to impinge on the duties and responsibilities of local school and library boards. As part of its leadership role, the Department needs to assess what technical assistance it can realistically provide and what is or could be available elsewhere.

FUNDING NETWORK IMPLEMENTATION: The Department of Education needs to tap a variety of sources to provide the mix of funding necessary to successfully implement a statewide educational telecommunications network. Sources include: federal, state, foundations, and corporations. Each of these funders has advantages and disadvantages.

o State: Most legislators interviewed expressed a belief that telecommunications could be funded with existing appropriations. The only area in which support was voiced for new monies was for front-end or one-time costs. Some legislators even limited this category to poor or rurally

isolated school districts.

o Federal: Many sources of federal funds have been eliminated in recent years. The National Telecommunications Information Administration will be issuing a Call for Proposals in the fall, and CDE should develop a proposal for submission. Careful consideration should be given to whether the types of projects that NTIA wants to fund would fit into state goals and objectives.

o Foundations: Colorado is fortunate to have a number of large foundations located here. Most of the eleven major foundations headquartered in Colorado list education, youth, or children as areas of emphasis. However, the Department of Education has not received any large grants from these groups in the past. The Commissioner and State Board need to approach the directors of these foundations to determine whether some mutual goals can be identified, so that Colorado schools and libraries can benefit from these local philanthropic sources.

o Corporations: Funding from these sources often takes the form of gifts of equipment, loan of staff, or joint ventures. Each approach has its advantages and disadvantages. Outright gifts of equipment or products may be valuable or may be obsolete items that the company wants to move out of its warehouse. Some corporations lend staff to public agencies, which could be a means of obtaining high-quality technical expertise. On the other hand, some companies use this technique as a means of giving "dead wood" employees something to do. Joint ventures often include development of pilot projects. If successful, the public agency has received a valuable asset for the cost of staff time and expertise contributed to the project. A difficulty arises if the corporation decides not to market the product, thereby leaving the public partner with a program that has a questionable future.

Criteria for Decision-Making: A certain amount of uncertainty or loss of autonomy is inherent in requests for funding. Also, foundations and corporations tend to be more interested in one-time projects, which does not solve the problem of long-term network funding. CDE leadership should examine the variety of funding sources and determine which ones can best be utilized to achieve different goals and objectives. No one funding source can meet them all. A mix of public and private funding sources should be selected that will permit the greatest degree of autonomy and self-direction.

DELIVERY SYSTEMS: There are a number of delivery systems available to local schools and libraries. As much as CDE might hope for uniformity, local decisions have already been made in many instances which would preclude that. Instead, the statewide educational telecommunications network will need to develop the capability of interfacing existing and planned projects. Some factors that should be considered include:

o How great is the need for compatibility between and among automated systems? This only becomes a concern when one system must communicate directly with another system. Otherwise, a certain degree of incompatibility can be tolerated.

o Will the decision to choose a particular delivery system exclude consideration of some alternatives in the future? One satellite instruction program, which has been highly promoted, calls for installation of a fixed satellite dish. A decision to select this programming would inhibit accessing other satellite instruction at a later time.

Criteria for Decision-Making: A statewide educational telecommunications network for Colorado will have to build on what other states have already done. This decision has many positive aspects in that Colorado can learn from others' mistakes and utilize their successful programs. CDE will also need to accept the fact that some school districts and libraries have made technology decisions of their own in the absence of a statewide plan. Telecommunications can be used to permit communications between and among disperate systems. Development of the Open Systems Interface (OSI) model will greatly relieve incompatibility problems.

CDE STAFFING AND ORGANIZATION: Most CDE staff interviewed for this Study indicated a sense of frustration at what they perceived as a lack of internal focus regarding telecommunications and technology. They proposed two different organizational patterns for dealing with the problem:

1.) Organize a CDE Technology Unit which would bring together all staff in the Department currently working in the areas of automation, data processing, technology, or telecommunications. This group would be specifically charged with implementation of the statewide educational telecommunications network. They would enlist the aid of other CDE staff as required to attain the Study's goals and objectives.

2.) Hire a senior-level staff person to coordinate the activities of any CDE staff involved with technology or telecommunications. This person would serve as the catalyst to ensure coordination, continuity, and accomplishment of designated tasks across Office lines.

The following suggestions were also made by staff and are recommended by the contractor:

o Create a series of internal and external committees to handle much of the organizational and coordination activities needed to implement the network. Having one person to oversee all committees would be an advantage, but not an absolute necessity.

o Examine whether any funds currently being expended by the Department of Education for technology and telecommunications could be re-directed to hire short-term expertise or contract out certain needed services to other agencies.

o Determine what portion of new activities undertaken for implementation of a telecommunications plan could be contracted to individuals or agencies with established expertise in specific areas. This action would be in lieu of hiring additional staff for network implementation.

One suggestion made by staff is not recommended by the contractor:

o Seek funding to hire a large number of new staff who would devote themselves to implementation of the statewide educational telecommunications network.

Criteria for Decision-Making: The contractor believes that successful implementation of this Study will be a full-time job. Hence, the need for a separate position filled by a person with the management and technical expertise to see that implementation activities are undertaken and completed on schedule. The contractor recommends a full-time implementation coordinator over the suggestion that a Technology Unit be created. Such a Unit might prevent staff "buy-in" of the Telecommunications Study.

The Commissioner and State Board of Education need to determine how much autonomy they wish to maintain regarding implementation of this Study. Some consideration needs to be given to what activities are currently being undertaken by CDE staff working in the areas of technology and telecommunications and whether that is the most cost effective means of accomplishing the tasks. Also, adoption of educational telecommunications as a high priority for the CDE may mean that some current job responsibilities must be abandoned in order to achieve the identified goals and objectives related to network development.

COORDINATION WITH OTHER AGENCIES: The Department of Education cannot plan and execute a statewide educational telecommunications network in a vacuum. It will be important to gain "buy-in" from other state and local agencies, professional associations, and existing telecommunications resources. Some participants in the proposed network include:

o CCHE and individual institutions of higher education: CCHE is studying how to use telecommunications to deliver teacher education, continuing education, and adult learning. The CDE and CCHE telecommunications plans do not have to be identical, but should not conflict on any major points. One area of special concern for CDE should be what the relationship will be between UNC (identified as the lead agency in teacher education) and CSU (identified as the lead agency in telecommunications). Decisions made in these areas could affect the ability of rural teachers to obtain certification or recertification courses easily.

o The State Department of Administration's Divisions of ADP and Telecommunications: They have a wealth of resources and expertise which are available to CDE. These resources have not been fully tapped in the past, and CDE should determine what assistance is available from state ADP and Telecommunications before hiring internal staff in the areas of technology and telecommunications. There is no need for CDE to duplicate services or expertise already resident in another state agency.

o Colorado State University and KRMA: They currently have satellite uplink capabilities and would like to work with CDE on developing instructional programming. KRMA currently has a number of instructional programs being broadcast, but has no satellite uplink capabilities. The use of

these two resources should be carefully planned to avoid duplication or overlap.

o Several components of the emerging Colorado Library Network will provide key elements of an informational telecommunications network. Major library network consortia are: the Colorado Alliance of Research Libraries (CARL) which has created an online catalog composed of university libraries and the Denver Public Library; the IRVING group, composed of public libraries in the Denver Metro area; and MARMOT, a database comprising many academic, public, and school libraries on the West Slope.

Criteria for Decision-Making: Plans of other agencies should be considered as CDE moves toward implementation of the statewide educational telecommunications network. Not all planning being done by others will be congruent with CDE's identified goals and objectives. However, obvious conflict with other state agencies should be avoided.

STATE BOARD OF EDUCATION

The State Board of Education, as governing authority for the Department of Education, has broadly-based powers and responsibilities under state Statutes. More importantly, the State Board exerts subtle influence upon local school and library boards by endorsing concepts, identifying priorities, and taking stands on trends and issues. For this reason, the Board's support is crucial in implementing a statewide educational telecommunications network.

A number of recommendations are made on the following pages. Some of them require significant amounts of funding, possible legislative action, or several years to attain. Others could be accomplished with a minimum of effort. Two recommendations are pivotal to accomplishment of most of the others, and both require action by the State Board of Education.

First, is a decision by the Board that implementation of a statewide educational telecommunications network is its top priority for the next two or more years. A number of other critical educational issues exist at the present time. Why then, should the Board place telecommunications above all the others? Because an effective telecommunications network will facilitate achievement of many other educational goals, such as: literacy, educational equity, education of exceptional children, etc.

Second, is creation of a top-level position within the Department of Education to coordinate network implementation. The individual hired as Director of Telecommunications should report directly to the Deputy Commissioner and serve as a member of the CDE Executive Committee.

The contractor does not recommend that one of the present Assistant Commissioners serve in this capacity, since staff might perceive that as showing favoritism to one Office's technology activities over another's. The contractor believes that successful implementation of this Study will be a full-time job. Hence, the need for a separate position filled by a person with the combination of management ability and technical expertise to see that goals are accomplished.

Some questions that need to be addressed are: How intrinsic will the state network be to the activities of CDE? How effective would declaration of educational telecommunications as the Department's top priority be if staff are not expected to work within this priority? If this stipulation is made, there needs to be a "natural fit", with all CDE programs being able to find a home within the priority. Identifying educational telecommunications as the Department's top priority should not jeopardize existing program goals and objectives. One way to assure that all staff embrace this priority is to increase awareness and training of staff in the areas of technology and telecommunications.

RECOMMENDATION: The State Board of Education should announce that implementation of a statewide educational telecommunications network is its top priority for the next two years. Although the Board has many other potential priorities to consider, telecommunications provides the vehicle for delivering all types of instruction and information. Board actions regard-

ing Department of Education budget requests, staff assignments, and grant awards should reflect this priority.

RECOMMENDATION: The State Board of Education should create a new position, Director of Telecommunications, as a senior-level position within the CDE. This person should report to the Deputy Commissioner and be charged with coordinating all activities related to implementation of this Telecommunications Study.

Members of the State Board of Education, as elected officials, have a great deal of influence which could be directed toward obtaining funding for the educational telecommunications network. Two recommendations speak to the Board using its influence to attract corporate and foundation funding.

The proposed meeting with representatives of major Colorado companies in the technology and telecommunications fields would provide an opportunity for the Board to alert the private sector to the Telecommunications Study and its recommendations. The Colorado Association of Commerce and Industry or area Chambers of Commerce should be approached regarding possible joint sponsorship of this meeting. A series of follow-up meetings with individual companies should explore how they could support implementation of specific recommendations. Initial corporate contacts should be by the State Board or Commissioner. Follow-up activities could be undertaken by the Director of Telecommunications.

Colorado foundations need to be tapped more aggressively than in the past for educational support. A recent article in the Denver Post revealed that the eleven largest foundations headquartered in Colorado distributed nearly $25 million during 1985 alone. Almost all these foundations list education, children, or youth as target areas for funding.

These eleven large Colorado foundations, plus selected smaller ones, should be contacted by the Board to inform them of the Telecommunications Study's goals and to identify recommendations which would fall within their funding criteria. Initial contacts should be made by the Board or Commissioner. Follow-up visits and development of proposals should be delegated to the Director of Telecommunications and other appropriate CDE staff.

RECOMMENDATION: The State Board of Education should host a meeting of major Colorado corporations doing business in the telecommunications and technology field. Purpose of the meeting should be to introduce the business community to the Telecommunications Study and solicit specific ways in which they could be supportive.

RECOMMENDATION: The State Board and Commissioner of Education should use the influence of their positions to tap funding from state and regional foundations. Foundation support can be one way to overcome the need for seeking large amounts of funding from state and federal sources.

The State Board of Education can also use its influence to effect use of telecommunications by local school districts and libraries. Also, telecommunications provides the means whereby Board members can alert citizens to

issues and obtain reactions. The technology used for these purposes ranges from interactive audio, to electronic bulletin boards, to interactive video.

If press releases about State Board actions and individual Board member activities were available via electronic mail, schools and libraries would be encouraged to use this resource. If CDE develops an "Education Hotline" and a "Hotline for Libraries", as this Study recommends, a separate bulletin board on State Board announcements and activities could be included. A bulletin board devoted to the State Board could include: summaries of Board meetings, announcements of speeches or appearances by individual Board members, and opportunitities for the Board to solicit input on issues from constituents.

From time to time, past State Boards have discussed the potential use of interactive audio (telphone conferencing) to permit testimony from persons unable to attend Board Rules hearings in Denver. Emerging technologies will permit interactive audio and video in the near future, so the Board should anticipate this opportunity. The Attorney General's Office should be approached to advise the Board whether any changes in existing Statutes or Rules would be required to permit testimony from distant locations.

RECOMMENDATION: The State Board of Educatión should issue press releases concerning Board actions to their constituents in schools and libraries via electronic mail. Not only will this provide Board members with an effective communications vehicle, but will demonstrate the Board's commitment to a statewide educational telecommunications network.

RECOMMENDATION: The State Board of Education should explore with the Attorney General's Office the legality of holding Rules hearing via teleconferencing. For the present, that would mean interactive audio along with electronic mail or electronic blackboard, but video (either interactive or one-way) will be possible in the near future.

Finally, the State Board of Education should solicit input from a broad spectrum of persons involved in telecommunications, technology, and information access in schools and libraries. There are a number of existing State Advisory Councils providing information to the Board in specialized areas such as special education, libraries, the disadvantaged, etc. In addition, task forces have recently developed recommendations in specific curricular areas such as math, science, foreign languages, etc. At the present time, no organizational structure exists to pull together all recommendations from these groups regarding telecommunications or technology. This Study proposes that a State Advisory Council be formed to analyze input from a variety of sources and make recommendations to the Board and Commissioner. The proposed Council, to be appointed by the Board, would be composed of practioners, administrators, and governing board members.

RECOMMENDATION: The State Board of Education should establish a Telecommunications Implementation Council. This State Advisory Council should be widely representative of all key players in the Colorado educational telecommunications field. Membership should be composed of practitioners, administrators, and governing board members. This Council should examine

policy issues related to successful implementation of the statewide educational telecommunications network and make recommendations to the State Board and Commissioner.

COLORADO DEPARTMENT OF EDUCATION

The Colorado Department of Education should exert strong leadership in directing development of a statewide network for educational and informational telecommunications. CDE should write the agenda for how schools and libraries can utilize this resource effectively. The decision to accept the agenda will still be a matter for local governing boards. This Telecommunications Study contains a number of recommendations. Not all of them will be appropriate or desirable for each local agency. Local boards and administrators have the responsibility of picking and choosing those activities that best meet their needs.

Implementing an educational telecommunications network is not a place in which the "bottom-up" theory will work. Some organization, hopefully the Colorado Department of Education, must lead the way. If the Department does not undertake this responsibility soon, others will act to fill the void without concern for statewide coordination or compatibility standards. Even though some educators or librarians may accuse CDE of trying to impose a "top-down" system, this leadership role should be undertaken.

As part of its leadership role, the Department needs to assess what technical assistance it can realistically provide, what is available elsewhere, and what can be provided best by contractors with specialized skills. There is reason to believe that the General Assembly will not appropriate the funds necessary to hire large numbers of additional staff at CDE to assist in network implementation. Hence, the Department needs to examine whether any current staff positions can be assigned to technology/telecommunications consulting, if any existing state or federal funds can be redirected to this purpose, and how other persons in the state can be tapped to provide assistance to schools and libraries. Without a clear direction for CDE staff to follow, there will be a sense of frustration because there is too much work to do and not enough staff to do it.

ADMINISTRATION:

The Commissioner of Education has specific powers and duties that are detailed in state Statutes. He is also able to utilize the influence of his office to cause a variety of activities to take place. To a lesser extent, CDE staff can also use their credibility, field contacts, and expertise to encourage schools and libraries to focus on implementing the goals and objectives contained in this Study.

The Colorado Commissioner of Education could exert leadership with other Mountain Plains or Western Chief State School Officers in the area of planning for effective utilization of educational and informational telecommunications and technology. CDE staff or an outside contractor will need to do a good deal of pre-meeting planning, both in the area of background materials and in development of the meeting agenda. Administrative assistance and possible funding help might be solicited from the regional educational labs in the geographic areas involved or from the Education Commission of the States. However, since each Chief would pay his/her way, the only expense would be for publication and mailing of pre-meeting materials

and possible contractor assistance in planning the meeting.

RECOMMENDATION: The Commissioner of Education should host a meeting of Chief State School Officers from western states interested in exploring formation of consortia for sharing educational and informational technology. Such benefits as group purchase discounts, reciprocity of programming, and access to highly technical assistance, can be outgrowths of such cooperation.

The credibility and expertise that make CDE staff effective in the field can be jeopardized if the Department is perceived by its constituents as being "behind the times". Also, CDE staff have a critical need to communicate with their various audiences in the field in the most efficient and cost effective manner. Hence, internal technology at CDE becomes a prime component in successful implementation of a statewide educational telecommunications network.

The present lack of commitment to technology within CDE can be demonstrated by how few microcomputers, terminals, and/or modems are available for staff use. In most instances, those units that have a moderately adequate supply of technology are on federal funding. Most CDE staff interviewed pointed out that even if they could find the money for equipment, it would be almost impossible to obtain funding for software, training, or telecommunications costs from their existing state budgets. (Many staff mentioned that their state operating budgets had remained the same or been cut in recent years.)

RECOMMENDATION: The Commissioner, Deputy, and Assistant Commissioners of Education should use an internal electronic mail system for all internal correspondence and an electronic scheduling system for setting all internal meetings. This practice will send a signal to staff and constituents that a commitment to technology exists at the highest level within the Department.

RECOMMENDATION: The Commissioner of Education should announce that after a certain date (probably one or two years in the future) all general announcements from the Department will be made via electronic mail. As of that date, the weekly mailing to school districts should also be disseminated electronically. Large documents could be identified by title in the weekly electronic mailing and sent Book Rate on a weekly or bi-weekly basis.

ELECTRONIC MAIL AND BULLETIN BOARDS:

CDE staff currently use a variety of electronic mail and bulletin board services. The multiplicity of those services at CDE causes confusion in the field. This gives the perception of a lack of decisiveness and focus at CDE in regard to technology. Also, they provide an excuse to schools and libraries that aren't enthusiastic about getting into telecommuncia-tions.

The types of bulletin boards utilized by CDE staff can be broken into two major categories: 1.) National services that provide CDE staff the ability to communicate with their peers in other states and to obtain up-to-the-

minute information about national issues; and 2.) CDE-developed bulletin boards, created by staff to serve the needs of a particular client group. This latter information is accessed by some means other than Easylink--usually by dialing directly into the database.

Electronic mail/bulletin board services currently being used by CDE staff include:

National Services:

The Source: Has bulletin boards for chief state school officers, state boards of education, and other items of national interest such as "U.S. Education". Their electronic mail service permits communication among chief state school officers, state board of education members, and others who subscribe to this service.

Easylink: Provides general electronic mail services and utilizes WATS access for customers outside local access nodes. The company offers a number of specialized bulletin boards. One example is InfoMaster, a collection of over 700 online databases, such as Education Resource Information Center, Electronic Directory of Education, Exceptional Child Education Resources, Federal Register Abstracts, Resources in Computer Education, and Texas Education Computer Cooperative. Document delivery is also available because Easylink is part of Western Union.

Special Net: Has bulletin boards for state-level special education administrators, as well as information about legislation and court decisions related to special education and the disabled. Their electronic mail service permits communications with other special educators in Colorado and nationally, as well as with persons interested in providing services to the disabled.

OnTyme: Provides electronic mail services to other state libraries, members of the BCR (Bibliographical Center for Research) Board of Trustees, as well as libraries and library vendors in other states and nationally. The State Library should also consider subscribing to ALANet (an electronic mail service provided by the American Library Association) for additional national library information and to gain access to libraries not on the OnTyme network.

CDE-Developed Services:

Ed-Net: This electronic mail and bulletin board service was developed by the CDE Education Technology consultants. Its purpose is to provide information and interactive linkages among students, parents, educators. Most users are within the Denver/Boulder toll-free area because others have to pay line charges for a long distance call into the database.

Talent Bank: This project should be operational by the spring of 1987. It will contain information on innovations, consultants, and the availability of technical assistance in all curricular areas. Access to the database will be via dial-in phone lines. Therefore, the service will be free to persons in the Metro area; others will incur long distance charges unless CDE is able to provide IN-WATS service.

Data Services: Certain internal databases are now available to school districts, libraries, or citizens via dial-up ports. The following information is currently available: teacher certification, pupil membership, certificated personnel, special education, student testing, and school district profiles. Plans call for the following databases to be available in fiscal 1987: special projects (Chapters I and II) and school finance analysis. Access to the databases will be via phone dial-in. Therefore, the service will be free to persons in the Metro area; others will incur long distance charges unless CDE is able to provide IN-WATS service. Hewlett Packard has informed the contractor that software is available to permit Easylink access to any databases running on the Department's HP3000 computer.

Administrative Issues:

Development of internal online systems can be attributed to a lack of central focus as to how CDE will communicate with its constituents via electronics. Since there are a number of talented, creative people on the CDE staff, it should come as no surprise that they have taken it upon themselves to fill the vacuum that exists regarding a clear educational telecommunications policy by creating their own databases.

Creation of internal databases raises several questions of an administrative or policy nature:

1.) Did anyone at a top administrative level within CDE authorize use of large amounts of staff time and state or federal funds for this purpose?

2.) How does the Department plan to integrate the information contained within these disparate databases into a total CDE database?

3.) What consideration has been given to any inconvenience that might be caused to clients in the field by requiring them to utilize several databases in order to access needed information?

4.) What is the cost of providing IN-WATS lines to provide equality of access to internal CDE databases? Can current CDE budgets accommodate these costs? If not, what are the chances the General Assembly will provide CDE with funds for this purpose?

RECOMMENDATION: CDE staff should be permitted to continue to access commercial or specialized electronic mail or bulletin boards in order to stay informed about national issues or to communicate with their peers in other state departments of education or state libraries. They should not have to make a decision between these national electronic mail systems and Easylink (or whatever system is chosen by CDE for general communication with the field).

Electronic Mail Networks in Other States:

A study conducted by the Northwest Regional Educational Lab (NWREL) indicated that most statewide networks contain similar components. The contractor has added additional components to the following list to answer the needs of libraries. Common elements include:

Correspondence: Memos or other items which might be mailed from the state agency, informational bulletin boards, legislative or legal updates, calendars of meetings or continuing education opportunities, conducting surveys or polls of users, individually addressed correspondence (whether to one person or many people). NWREL suggested that a survey or poll "is a particularly powerful tool for finding out what school superintendents or other groups think of newly proposed legislation, regulations, or similar state proposals."

Management Information: The NWREL study noted: "The real value of a communication network for management information is the capacity to transfer cost, budget, accounting, personnel and other management data between the user and the central computer." The study also noted: "There are many advantages to electronic data transfer of management information, including the remote entry of data for state reports which would eliminate the need for SEA keypunching of the data."

Instruction: This system could be used for computer assisted instruction for teachers and librarians, and teachers could use the electronic mail system to share curriculum materials or successful teaching practices with their peers in other parts of the state.

Testing and Evaluation: NWREL was unable to find any state using its communications network for this purpose. OTIS (Oregon Total Information Service) has investigated the feasibility of "entering test data via remote terminal and reporting scores back to the districts electronically." NWREL felt that a potential for statewide networking would be "using a central data processing facility to store and make available information on items such as Chapter I evaluation results and standardized test instruments. It may also be possible to use a network to access socioeconomic data available in a large computer and correlate that information with testing and evaluation data."

Access to Information Databases: Studies in Pennsylvania indicate that students increase their research and information-accessing skills when online databases are available to them. Such databases could be locally developed, available at other schools via Easylink, or commercially available.

Access to Statewide Databases: New Jersey has completed development of a statewide database containing information about such topics as: school finance, student data, achievement scores, and certification. The NWREL study indicates that this information is available to any citizen who has the technical capability to access the system and who obtains an identification number from the state department of education.

Access to Library Resources: It is critical that educators have access to a wide range of learning resources. Colorado's movement toward a statewide library network will permit CDE staff and local school district employees to access a wide range of library resources online.

The NWREL study recommended use of commercial communications networks over development of state-owned networking capabilities for the following reasons: "The state is not responsible for procurement, maintenance and operation of

the system's hardware and software." Their study also noted: "In addition, once a school district has paid its subscription fee, it has access to all of the services available through that particular network. This 'value added' concept is a strong point in favor of the national service vendors."

NWREL pointed out that Alaska is the only state currently operating its own telecommunications network. One disadvantage of such a system was illustrated recently when Alaska schools lost part of their network capabilities because the Department of Education suffered a state funding cut.

Most states studied by NWREL expected local school districts to pay the cost of purchasing necessary equipment to access the state telecommunications network. Many states were exploring a state subsidy for some or all of the other costs of networking. NWREL noted: "the higher the cost to the local school district, the less likely the district was to participate in an electronic network. Resolving the communications cost issue will be critical to the success of future systems."

Another important factor to making any electronic communications network a success is getting all users to check their mailbox every day. Otherwise, time-dependent messages are not received in time. This means that several people have to be trained to use the system, so that the vacation or illness of a staff member cannot tie up the agency's ability to access its mail.

Concerns Expressed About Easylink:

Easylink was touted to school districts and libraries as the "official" communications network for CDE. Unsophisticated users find it hard to access more than one electronic service. However, at the present time, CDE staff are using several electronic mail or bulletin board services for contacts with and from the field. Comments from administrators include: "CDE does not have its act together", and "the right hand doesn't know what the left hand is doing at CDE regarding technology and telecommunications".

Presently, staff opinions about Easylink differ widely. The CDE Field Reps reported that they really depended on their TRS-80 portable microcomputers and the Easylink electronic mail system to keep in touch with their office while in the field.

Other CDE staff expressed concern that Easylink only provided electronic access to the school district level; that most building-level staff did not have access to Easylink or any other electronic mail service. Several persons within CDE told the contractor that one person in a school district or main library might have an Easylink account, but wouldn't permit others to use it. Part of the problem seems to be connected to budgetary constraints; e.g., "If I let someone use my Easylink account, their charges will be billed against my budget."

Easylink currently charges 30 cents per call for access to their WATS line. This places additional costs on rural schools and libraries. However, the CDE-developed databases require that a school or library pay long distance charges, which are higher than the Easylink access fee.

Several explanations were made by CDE staff regarding the need to develop internal bulletin boards outside of Easylink. These included:

o Some informational databases are already resident on the Department's HP3000 computer and there is no current Easylink access to that equipment.

o Bulletin boards on Easylink are not interactive.

o The diversity of microcomputers and software programs within CDE units causes problems in staff being able to help each other solve any problems with Easylink use as they arise, since they tend to only know how to access Easylink on their own equipment.

All of the above concerns have been addressed in a meeting that the contractor had with an Easylink representative. For example:

o The Easy Software Company of Salt Lake City has a program available that will permit Easylink access to the Department's HP3000.

o Internal databases needing interactive components could be resident on the HP3000, which would then provide Easylink access, thus saving on long distance phone charges for persons outside the Denver/Boulder area.

o If a school district or library already has an Easylink "mailbox", additional "addresses" can be added at no charge. This will encourage expansion of the service to the building level. In fact, there could be several "addresses" within a single building if that is desirable for confidentiality, billing, or other reasons.

o A single message can be sent to a large number of people with ease on Easylink by using their RediList capability.

Many of the problems which have been encountered by schools and libraries in Colorado can be attributed to the multiplicity of hardware and software systems being used to access Easylink. It appears that the State Board for Community Colleges and Vocational Education has avoided many of these problems with implementation by funding standardized equipment and software at a large number of sites across the state.

Although Sandy Lardinois, the CDE staff member assigned to assist with Easylink implementation, has left the Department, staff at the Easylink office are available to answer questions and to provide assistance and follow-on training.

A number of CDE staff expressed a lack of confidence in the reliability of the CDE internal phone system. One staff member summed it up with: "I wouldn't consider using this phone system to send out an important message to my constituents in the field. Half the time when I just try to transfer a call to another phone, I lose the call." Whether this statement is valid or perceptual, it is one that will have to be dealt with if CDE staff are going to be enthusiastic about using an electronic mail system.

The contractor recommends that one electronic mail and bulletin board

system be utilized by CDE to communicate with its clients in the field. This network should be Easylink unless some compelling reason emerges to indicate the need for a change. CDE staff must be convinced of the importance of whatever system that is selected.

RECOMMENDATION: CDE should decide to use Easylink, currently in use by some CDE staff and some local schools, BOCES, libraries, and RLSS, or choose another electronic mail system. All CDE information should be accessible via one system—a system that will not penalize those in rural areas.

Promoting Electronic Bulletin Board Use:

The Department could get people interested in using electronic bulletin boards by developing one or more "Hotlines", which would contain the latest, topical news. Likewise, the State Library could produce a "Hotline" covering similar issues of interest to librarians and information providers. Information contained on the two "Hotlines" would be of a local, state, and national nature. Some examples of topics that could be covered are: results of school and library bond elections; summaries of actions taken at the monthly State Board of Education meeting; updates on pending legislation or funding issues on the state and national level; and announcements of appointments, resignations, and retirements of Colorado educators and librarians.

Often seminars, programs, or conferences are held at a time or place that does not permit all interested parties to attend. If arrangements could be made to video tape these events, they could be offered to Colorado educators via the CDE Film Service. An electronic bulletin board would give brief synopses of the programs including speakers, topics, intended audience, etc. Video taping could be done by school district, community college, or university staff located in the area of the presentation.

RECOMMENDATION: CDE should develop an "Education Hotline" electronic bulletin board. This would contain the latest news from national, state, and local levels. It would promote use of CDE's electronic mail system by educators across the state.

RECOMMENDATION: The State Library should develop an electronic "Hotline for Libraries" that would provide the latest news from local, state, and national levels. This would be particularly valuable to staff in small libraries who do not have access to professional library publications. It would also promote use of the CDE electronic mail system by librarians in the state.

Need for ADP Planning:

What can be done about the duplication of effort that currently occurs at CDE in getting records into machine-readable form and then accessing that information? For example, Title VII has been criticized for collecting data that are already in the CDE database. However, Title VII staff feel that they will not have access to this information unless they collect it. Also, how can information in specialized databases, e.g., migrant education

and special education, be made more readily available to principals, superintendents, and school board members? There needs to be better coordination between and among CDE databases. For example, the present migrant education database does not contain information about immigrants.

If there were some way to download information from the HP3000 computer to microcomputers, Department staff would not have to take already-automated information and re-keyboard it into their micros. People in Data Services say that they currently have this capability, but other CDE staff say that is not the case.

RECOMMENDATION: CDE should develop a cohesive, comprehensive, Department-wide Automated Data Processing plan, which would be presented to the Colorado General Assembly for funding. Those state agencies that have taken such a course have been fairly successful in obtaining needed support.

STAFFING:

Many businesses are coming to the realization that they need a Telecommunications Manager, just like they need a Data Processing Manager, or a Personnel Director. This individual is charged with assuring that everyone in the company is utilizing the telco equipment and services effectively. He/she would handle any problems, arrange for needed training or re-training, and serve as the coordinator of all telco efforts that might be happening throughout the corporation. In most corporations, this is a staff, not a line, position.

There needs to be better internal coordination of technology and telecommunications activities within the CDE. There appears to be a cohesive plan within some CDE Offices, but others appear to permit a laissez faire attitude. That may engender creativity, but will not move the organization toward a commonly identified goal in the most efficient manner.

As in CDE's dealings with the field in this area, there needs to be a top-down approach. The CDE Executive Committee needs to spell out clear directives for staff to follow. Then the Director of Telecommunications can work with CDE staff to see that those directives are implemented.

RECOMMENDATION: The CDE Director of Telecommunications should track emerging telecommunications technologies that might hold promise for education or libraries. Also, some existing systems are not now cost effective, but will be in the near future. Tracking of telecommunications should be accomplished by reading specialized professional publications and attendance at conferences or meetings on these topics.

RECOMMENDATION: The Director of Telecommunications should serve on all proposed committees to provide continuity and prevent duplication or overlap.

Requests for Technology/Telecommunications Assistance:

A number of CDE staff receive requests for assistance in the areas of

automation, educational technology, and telecommunications. The Field Reps often receive questions from superintendents, school board members, and BOCES directors. Special Education staff field questions from teachers, therapists, and parents about how technology can improve the quality of life for the handicapped. In addition, the two Education Technology consultants at CDE receive requests for technical assistance, training, and trouble shooting.

Because of a lack of clear channels for inter-Unit or inter-Office communications within CDE, consultants are often faced with trying to answer queries when they should be referred to someone else within the Department. For example, several staff mentioned to the contractor the difficulty they had trying to find journal articles to respond to field requests for information about a variety of emerging technologies. Such requests should have been turned over to staff of the CDE Resource Center who have specialized training in locating and accessing informational resources, so they can complete the job more efficiently. Also, delegating requests for assistance to the staff member most qualified to deal with it will assure that each consultant has time to complete the tasks for which he/she is uniquely qualified.

RECOMMENDATION: The CDE Executive Committee should examine how requests for assistance from the field are currently handled by CDE staff. The CDE Technology/Telecommunications Committee should be directed to determine whether an internal electronic mail and bulletin boards system could provide the vehicle for assigning field requests for telecommunications/technology to the staff member or contractor best qualified to respond.

Training:

Training is very important to the success of any technology-oriented project. However, as Gerry Ryan, formerly with the Massachusetts Department of Education, observed: "What's tough about anybody participating in training is the time needed to sit down at the computer and work on your own applications. I quickly became aware that just participating in microcomputer training is inadequate. It takes a varied amount of time to feel comfortable with the machine. It takes on-machine time. After the first round of training, I learned that points are driven home only after you work on your own applications."

Educators often have difficulty finding appropriate training opportunities. Certainly, computer fairs are good for providing an overview of new hardware and software, but they offer little, if any, training. When workshops are offered, it may be difficult for staff to get release time to attend. CDE, as well as local schools and libraries, need to consider how initial and continuing staff training can be provided on-site or close at hand.

CDE staff training needs can be broken into several different components:

- o Original equipment/software training
- o Expanded skills training of staff who have mastered the initial training sequence.

o Structured in-house opportunities to exchange information/experiences; such as users' groups. (These should be inter-Office and intra-Office groups.)

o Overview of new technologies; e.g., computer fairs, technology demonstrations, etc.

o Attendance at regional/national conferences to exchange and gain information regarding technology developments in other states which could be replicated in Colorado.

RECOMMENDATION: Opportunies must be provided and funds appropriated for CDE staff to gain proficiency in utilization of a variety of educational telecommunications technologies in order to make them more effective in the performance of their job responsibilities.

INTERNAL COMMITTEES:

The contractor recommends creation of three internal CDE committees to carry forward implementation of the Telecommunications Study's goals and to provide input regarding needed additions or modifications to the Study which may arise as network development takes place. Another purpose of the internal committees is to provide CDE staff with a sense of participation in network implementation. This staff buy-in is a critical component for assuring broadly-based participation by schools and libraries. The three proposed committees serve separate, but interlocking, functions:

Technology/Telecommunications Committee:

The Technology/Telecommunications Committee brings together staff with the highest level of technical expertise. Since the contractor did not recommend formation of a Technology Unit, this committee serves as the catalyst for inter-Office communication and coordination relating to technology and telecommunications.

RECOMMENDATION: The Commissioner of Education should establish a CDE Technology/Telecommunications Committee composed of the most technically qualified people within the Department, with representation from every Office. The Committee would consider technology/telecommunications problems within CDE; make recommendations regarding utilization of emerging technologies or the need for modifications in existing internal systems or equipment; and advise Offices, Units, and Program Managers regarding integration of technology and telecommunications into CDE programs. This Committee would also be charged with working with CDE staff to assure usability and compatibility of new systems with existing technologies.

RECOMMENDATION: The CDE Technology/Telecommunications Committee should study the issue of costs related to changing from a paper to an automated communications system and report these findings to the CDE Executive Committee. Staff are concerned that savings in reduced paper transmission may not off-set increased telecommunications costs. This may be true for the next few years, so additional monies could have to be made available to staff if they are to be expected to use the electronic mail and bulletin

boards.

CDE Users' Group:

The Users' Group provides a means for staff who use technology and telecommunications on a daily basis to report on its effectiveness and make suggestions concerning areas needing improvement.

RECOMMENDATION: The Commissioner of Education should create a CDE Users' Group, composed of staff who use technology on a daily basis. This Group would alert the CDE Technology/Telecommunications Committee about problems, concerns, and needs related to usefulness of existing CDE technology/telecommunications and identify areas needing study by the Technology/Telecommunications Committee.

Technology Policy Committee:

The Technology Policy Committee reviews recommendations from the other two committees and from other sources and considers budgetary, legislative, or legal issues which might arise. This committee brings together staff and senior-level administrators within the Department to discuss and consider a variety of issues. A committee with similar membership has been used with successful results by the Colorado Department of Highways.

RECOMMENDATION: The Commissioner of Education should form a CDE Technology Policy Committee to provide a means of assuring focused direction in implementing internal automation, and to serve as a forum for consideration of policy implications regarding recommendations coming from the Users' Group and Technology Committee. Membership of the Committee should be equally divided between staff and senior administration (e.g., Unit Director or higher.)

RECOMMENDATION: The Director of Telecommunications should serve on all proposed committees to provide continuity and prevent duplication or overlap. [Repeated from the Colorado Department of Education, Staffing, section.]

LOCAL DECISION MAKERS

Successful implementation of this Study will not occur unless decision makers at the local school and library level analyze this Study and determine how they can utilize it to assist in meeting their own goals and objectives. All recommendations made in this Study will not be relevant to any one group of local decision makers. It will be the responsibility of local boards and administrators to identify those recommendations that they can support and assist toward achievement.

SCHOOL DISTRICTS:

As the major source of elementary and secondary education in the state, Colorado's public schools need to consider how an educational telecommunications network can improve the effeciency and effectiveness of instruction. Careful analysis of the recommendations proposed in this Study can provide large and small districts with the basis to compare their plans for implementing technology and telecommunications in light of an emerging statewide planning effort.

School Boards:

School board members must become convinced that educational telecommunications and technology are not gimmicky or unduly expensive. This Study suggests cost-efficient ways in which schools can accomplish their educational goals and objectives. Boards needed to be reminded that the concept of a statewide educational telecommunications network is not a fad; it won't just away if they ignore the issue.

Some school board members may feel that educational telecommunications falls into the same category as hula hoops and pet rocks. This is probably caused by the fact that they obtained a good education without the help of technology. The difference is that students attending school now will be adults in the Twenty-First Century. Also, their cohorts in other school districts have access to educational technology, so students lacking this component will graduate with a "second rate" education. Minesota Governor Perpich expressed this sentiment well when he said: "We cannot send out students into a high technology work with a low technology education."

Local school boards need to consider the important policy issues that emerge as they consider educational technology and telecommunications issues. Considering the complexity of the hardware and software, it should come as no surprise that there are no easy answers in this arena either. Are decisions concerning selection of technology/telecommunications hardware and software made at the district or building level? Either approach works, but some consideration should be given to which would be more compa tible with current district policies and procedures. District level decision making in regard to educational telecommunications will lead to greater compatibility, especially if the ultimate goal is to network between buildings. However, building level decisions about hardware and software may do a better job of meeting individualized needs within a faculty and student body.

Cost is always an important issue, but a number of others arise when instruction is being delivered from a distant site. Among the points to consider are:

o Are teachers who are presenting the coursework certificated, either in Colorado or in the state where the broadcast is originating? If not, has the CDE Certification Unit been consulted about possible violation of state Statutes or Rules?

o Does the instruction that originates from another part of the country reflect any mores, philosophies, or viewpoints that conflict with those in your school district?

o Have you and/or your administrators examined all textbooks and supplemental materials used by distance learning teachers to determine their appropriateness in your school district?

RECOMMENDATION: Local school districts should examine the curricular content, instructional concepts, textbooks, and supplemental materials of distance learning courses. Some may not fit into their community's philosophy.

School Administrators:

Superintendents and principals should be aware that there is no one instructional program that is best suited to meet local student and teacher needs. Some points that administrators need to consider are:

o What is the total cost of the program, counting such components as equipment purchase or lease, fees, teleccommunications charges, supplemental materials, etc. Also, which of these costs is a one-time item versus a recurring cost?

o If district already owns a satellite dish or can obtain one from a local cable company, is it compatible with the satellite instruction you want to access?

o What specific microcomputer hardware and software are required by the program you have selected? Does the district currently own any of these items? If you own other equipment, have you considered whether programs exist that would utilize you existing hardware?

o Will each of several buildings in your district need specialized equipment in order to access this instructional program. How will that affect costs?

o If the district decides to purchase instructional programming from one vendor, will that close the door to consideration of other programs in the future? Does the selected program require equipment that could not be used in another program if a decision were made to change instructional delivery systems at a later date?

RECOMMENDATION: Superintendents and principals need to consider all the implications connected with selection of instructional delivery systems. Cost is an important factor, but only one of many that should be studied in depth before a decision is made which could commit the district to a course of action for some time in the future.

A number of CDE staff indicated to the contractor their belief that some school administrators were unable or unwilling to pay the price necessary to support implementation of an educational telecommunications network. Some CDE Consultants stated that their clients in the field had expressed concern that their administrators were not supportive of educational technology and telecommunications. On the other hand, the Regional Field Reps felt that local school administrators were willing to pay for technology/telecommunications if it could be demonstrated that the new programs would improve the district's quality of education.

RECOMMENDATION: The Commissioner of Education should confer with school superintendents to clarify which of these conflicting perceptions is valid. He should inform CDE staff of his findings.

Boards of Cooperative Educational Services:

BOCES, as intermediate service units serving member school districts, should take a leadership role in assisting local boards and administrators in successfully implementing components of the educational telecommunications network in their region. Certain activities may lend themselves to BOCES responsibility because of the cost, critical mass required, or need for coordination with other agencies in the geographic area. BOCES should also explore the desirability of planning multi-BOCES projects, especially in areas of the state where a large number of small school districts exist, where schools are particularly isolated, or where one BOCES has already exhibited expertise in a particular learning technology.

RECOMMENDATION: Colorado's Boards of Cooperative Educational Services can serve an important function by coordinating implementation of educational telecommunications on the multi-district level. BOCES should also consider projects that would lend themselves to multi-BOCES planning and implementation.

LIBRARIES:

As the major access points to instructional and information resources, libraries play an important role in implementation of an educational telecommunications network. Colorado has a long history of cooperative resource sharing among all types of publicly funded libraries, which will strengthen the resource base available to all citizens.

Library Boards:

Governing authorities for libraries are determined by the organizational pattern in which the library operates. Academic and school libraries are part of larger agencies and usually share a governing board with that

entity. On the other hand, public libraries may have a separate board of trustees which operates with a certain degree of autonomy or the board may be only advisory in nature with decision making resident in the city or county government.

The library community has taken a leadership role in bringing automation to resource sharing by developing standards for storage and retrieval of bibliographic records. Libraries, both in Colorado and across the country, have welcomed the ability to form consortia for resource sharing that online databases provide.

RECOMMENDATION: Library boards, whether autonomous, part of a larger structure, or advisory, should take a leadership role in supporting resource sharing activities in their community.

Library Administrators:

Because of the interlocking responsibilities of all publicly funded libraries to support lifelong learning, library administrators can play a key role in implementation of recommendations contained in this Study. The library director should take a leadership role in assuring that the library's goals and objectives are examined in light of the recommendations in this Study. Certainly, libraries must serve the needs of their primary clientele first, but Colorado's historic commitment to multitype library cooperation and resource sharing should lead libraries to also consider the needs of other types of libraries in their geographic area.

Library directors, in particular, should provide opportunities for their staff to discuss how they can contribute to implementation of the statewide educational telecommunications network. Public and academic libraries are often impacted by decisions made by school boards and school administrators. This happens because the student becomes a public library patron after school hours, and the academic library is often called upon to support resource needs of advanced classes. Therefore, the public and academic librarians should familiarize themselves with decisions concerning implementation of this Study that might impinge on other libraries in the community.

School library media specialists, in particular, should make sure that they are aware of plans and decisions regarding educational telecommunications within their own school and district. They should volunteer to work with other teachers and their principal to assure adequate access to resource needed to support the curriculum. This becomes especially critical when instruction is being provided from a distant site and no teacher is available in the school to confer with the media specialist about student information needs.

RECOMMENDATION: Librarians should be aware of the critical role they can play in assuring successful implementation of the statewide educational network. Directors and staff of academic, public, and school libraries should examine how they can contribute to resource sharing within their city, county, etc.

Regional Library Service Systems:

RLSS have been assigned a major responsibility under state Statutes for coordinating the sharing of resources among all publicly supported libraries within their geographic area. RLSS boards and directors should work closely with the boards and administrators of their member libraries to determine how they can support both state and local activities related to implementation of a statewide educational telecommunications network.

Regional Systems should give special attention to analyzing this Study in light of already planned or currently existing technology or telecommunications for their member libraries. Certainly, no agency needs to concur with all recommendations contained herein, but efforts should be made to indentify any glaring conflicts.

RECOMMENDATION: Regional Library Service Systems should take a leadership to assure that all types of librarians within their area have an opportunity to discuss recommendations in this Study in light of local needs, goals, and objectives. This can best be accomplished by sponsorship of meetings, conferences, and seminars that will provide a forum for meaningful analysis of how libraries can contribute to implementation of a statewide educational telecommunications network.

FUNDING STRATEGIES

A statewide educational telecommunications network will not happen without adequate funding. Many persons interviewed by the contractor felt that adequate funding could be found if utilization of technology and telecommunications were CDE's top priority.

It will be necessary for the State Board of Education and Commissioner to take a multi-faceted approach toward funding this proposed statewide network. No state which has developed a similar network thusfar has funded it from a single funding source. Alaska used several federal funds, plus large amounts of state money. Minnesota's legislature appropriated more than any other state toward improving educational equity through telecommunications. Even there, however, the $6.3 million appropriated over a biennium was supplemented by large amounts of local school funds and private sector contributions (either cash or in-kind).

FEDERAL FUNDS:

This is not a propitious time to be looking to the federal government for funding. Many federal programs have been cut, or have not received cost-of-living increases in recent years. It appears that there might be increased funding for math and science programs. However, until the regulations are released, it is premature to assume that the increased funds could be used for technology or telecommunications projects. Changes in federal programs should be monitored closely by CDE.

The National Telecommunications Information Administration (NTIA) will make a Call for Proposals in September or October, with a submission deadline of about January 15, 1987. They will be distributing approximately $22 million, with no maximum limit on individual proposals. The timing of this Call for Proposals is opportune for CDE because this Study will be completed at that time. Thomas Hardy, the NTIA Program Officer, is available to offer technical assistance to states that are developing proposals, and he has been alerted that Colorado might be interested in a submission during the next round of funding.

RECOMMENDATION: CDE should submit a proposal to the National Telecommunications Information Administration (NTIA) during the next Call for Proposals (Fall, 1986 to January 15, 1987) to seek funding for a major component of the statewide educational telecommunications network.

STATE FUNDS:

It should be pointed out to the General Assembly that a perception exists among educators and librarians in the state that the legislature does not support CDE's efforts in the area of improving access to technology and telecommunications. Numerous persons in the field mentioned to the contractor that the two people in the CDE identified as Education Technology Consultants are paid with federal, not state, funds. This, they felt, was an indication of the lack of legislative commitment to educational telecommunications.

It is interesting to analyze the level of funding in other states for development of an educational telecommunications network. Three different statewide telecommunications programs are examined in detail so that readers of this Study can determine the variety of cost factors which need to be considered: Since each state had different goals and objectives, it is not possible to find direct parallels in all cases.

Minnesota:

It is interesting to compare Minnesota with Colorado because the population size, adult educational attainment level, state/local funding of education, and rural/urban mix are similar. For example, 70% of Minnesota's funding for K-12 education comes from the state. This equates to a biennial appropriation of $2.6 billion for the 710,000 students.

As mentioned previously, the Minnesota Legislature appropriated $6.3 million during a biennium for a wide range of educational technology and telecommunications programs. These included:

- Subject Area Inservice Training: $500,000
  (The MDE was permitted to use up to $50,000 for administration and evaluation of the program.)

- Instructional Effectiveness Plan: $50,000
  (To the Commissioner of Education for development of statewide plan for maintaining and improving instructional effectiveness in the schools.)
- Instructional Effectiveness Training: $300,000
  (No more than $15,000 of the appropriation could be used for evaluation.)
- Academic Excellence Foundation: $150,000
  (The MDE was permitted to use no more than $50,000 for administrative costs.)

- Technology Utilization Plans: $650,000
  (The MDE was permitted to use up to $63,00 of the appropriation to develop model plans and criteria, assist districts to develop plans, and evaluate the program.)

- Inservice Training for Use of Technology: $936,000
  (The MDE was permitted to use up to $220,000 of the appropriation for supplemental regional or state inservice training.)

- Courseware Package Evaluation: $200,000

- Courseware Purchase: $500,000

- Courseware Package Development: $500,000

- Technology Demonstration Sites: $2.2 million
  ($300,000 was earmarked for travel and substitute teacher costs for visitation to the sites from other schools in the state. The MDE was permitted to use up to $15,000 of the appropriation for administration of the program and up to $40,000 for project evaluation.)

- o Purchase of Courseware Duplication Rights: $225,000

- o Additional staff at MDE: $125,000

In addition, the Educational Computing Consortium received an appropriation of $560,000 for regional instructional computing coordinators. The regional coordinators were charged with providing on-site instructional computing expertise to the districts re: technology utilization planning and inservice training.

Technology Demonstration Sites:

Purpose of the Technology Demonstration Site (TDS) program was to develop a number of interactive video projects, utilizing a variety of technologies. Grants under this program required 50-50 matching funds from school districts. (Persons interviewed at the Minnesota Department of Education and in local school districts felt that the matching component was very important —they saw it as the major way to increase the chances that projects would continue after the grant period.) After two or three years, most projects are down to 39% state funding and 61% local funds.

The East Central Minnesota Educational Cable Consortium Project:

In order to generate private sector support, many projects worked with local telcommunications companies. An analysis of the ECMECC (East Central Minnesota Educational Cable Cooperative) project will illustrate how the TDS program operated and how relationships were built with local telecommunications companies.

Project impetus came from the offer of an educational channel as part of the bid submitted by a cable company wanting to start service to citizens in the area. The cable company helped the ECMECC write equipment specs, supervised installation, and handled trouble shooting. There have been problems caused by a change in ownership of the cable company.

Project start-up costs were: $389,260 capital outlay and $169,350 operating costs. During the 1985-86 school year operating expenses totaled $111,418. The project serves 7 school districts.

Oklahoma:

The satellite instruction program in Oklahoma is an outgrowth of two things: Oklahoma State University's (OSU's) existing teleconferencing program and legislation passed in the spring of 1985 to address educational quality issues. The Educational Improvement Act of 1985 (OS 70-18-125, 1985 supplement) was designed to increase high school graduation requirements and provide state assistance to school districts impacted by this legislation. Funds granted under this program were to be spent in the following curricular areas: mathematics, science, computer education, foreign languages, and music.

Appropriations were made to encourage small schools—those with an average daily attendance of less than 800—to join consortia or to contract with

larger school districts or institutions of higher education for services. Each eligible school district could receive up to $50,000 based upon a project application made to the Oklahoma Department of Education. This legislation, entitled The Small Schools Cooperative Program, received funding totaling $1 million for the 1985-86 school year. Because of severe economic problems in Oklahoma, the appropriation was cut to $900,000 for the 1986-87 year. Grant funds could be spent for the following expenses: personnel, student costs, equipment, and materials in the approved subject areas.

Since foreign language was a high priority with many districts, OSU agreed to broadcast a German by satellite program using a strong German professor who was on their faculty. Response to the telecast was so positive that OSU expanded the program to include German II and physics. The state legislature made a special appropriation of $175,000 to OSU to develop the physics coursework specifically for high school students. (The German I and II courses are identical to those the professor teaches to his college students.)

Currently, 90 school districts are online for the 1986-87 school year. This includes 48 districts using only German I, 14 school districts accessing German II, and 28 districts receiving the physics programming.

Utah:

The Utah Department of Education (UDE) wanted to develop a Spanish by satellite program to help rural schools meet increased high school graduation requirements. They decided that video programming would be enhanced and reinforced by microcomputer software containing voice synthesizer capabilities. UDE determined that IBM had the best software program of this type, so they approached IBM to work jointly with the Department on the Spanish project.

As detailed in the Instruction section, IBM ultimately loaned 179 microcomputers to Utah schools. In addition, they contributed $120,000 toward front-end costs and provided a great deal of technical support. In return, Utah copyrighted the program and gave IBM exclusive marketing rights.

The Utah project had another corporate participant: Bonneville International, Inc. They donated studio time and expertise for broadcasting the program, as well as satellite uplink costs. (The average cost of satellite transponder time is $450 to $700 per hour, so their contribution was not insignificant.)

In addition to corporate contributions, the Utah state legislature appropriated $220,000 for program development, and the Utah Department of Education committed extensive amounts of staff time. UDE administrators estimate that total development costs came to approximately $1.5 million. This does not include $210,000 spent on revisions to the program, which were the result of evaluations of the program's first year of broadcasting.

Colorado Legislative Opinions Regarding Educational Telecommunications:

The contractor interviewed several members of the Colorado General Assembly

to ascertain their feelings about educational telecommunications in general and their willingness to support funding requests in particular. There appears to be a perception among some legislators that schools will save money by utilizing technology and telecommunications. Information needs to be presented to them that such coursework would be additional classes required by increased graduation requirements and increased college entrance requirements. Other legislators believe that it should be possible to utilize existing telecommunications facilities in Colorado, such as CSU, or instructional telecommunications programs originating in other states for very little cost.

Comments from legislators included:

o A challenge grant from industry or a foundation which called for state matching funds would be hard to ignore.

o School districts should try to build on the availability of cable companies in their area.

o An educational telecommunications network that addressed some of the continuing issues of equity would have legislative appeal.

o It will be important for the educational community to present a united front to the legislature in seeking additional funding for educational telecommunications.

o Front-end costs of utilizing instructional telecommunications could be beyond the financial capabilities of small or poor school districts.

o Would only support funding requests that would benefit a majority of students, not just a small number of students in rural schools.

RECOMMENDATION: The Colorado education and library communities must present a unified plan to the General Assembly regarding funding for a statewide educational telecommunications network. Most legislators interviewed by the contractor were willing to consider requests for funding if--and only if--they were well thought out, cost effective, and represented the collective thinking of major participants.

RE-DIRECTING EXISTING STATE AND FEDERAL FUNDS:

Specific mention was made by many CDE staff of the need to use the Department's capital outlay budget for improving internal technology/telecommunications capabilities. Others mentioned that units with federal funds had flexibility to automate if they wanted, but those on the state budget were at the mercy of the General Assembly.

A number of existing projects and units within CDE currently have automation, technology, and telecommunications activities. If only a small portion of CDE funding were re-directed, it could make a difference in the overall ability of the Department to respond to educational technology needs. Also, the CDE makes a vast number of grants to school districts, libraries, and other agencies. If as many of these grant programs as

possible were focused on technology and telecommunications, that would make a significant impact on implementation of the network.

An analysis by Hewlett Packard personnel verified the conclusion of the contractor that full access to the telecommunications technologies needed for electronic mail and bulletin board capabilities to all CDE staff members at their own desks could be accomplished in three years if CDE capital outlay funds were earmarked for that purpose. In fact, the same goal could be attained in two years if some staff were not provided with microcomputers. (The HP proposal was predicated on the assumption that all staff required microcomputers; whereas, the contractor believes that as many as half the staff would only need or want a terminal and modem in order to access the network. Many CDE staff would be satisfied to have less sophisticated access to electronic mail and bulletin board services which would mean a significant cost savings.)

RECOMMENDATION: The Commissioner of Education should earmark state capital outlays funds for FY'87, '88, and '89 toward bringing telecommunications access to all CDE staff. All federal funds that can be expended for this purpose should be so designated.

BUILDING ON EXISTING RESOURCES:

Educational telecommunications programs exist in-state and nationally that could be utilized to create portions of Colorado's network. Some of the major projects and their cost implications are:

CSU: Their satellite uplink capabilities are mentioned by state legislators as an inexpensive means of providing instructional programming to Colorado schools. Although CSU has expressed an interest in working with CDE on educational telecommunications solutions, these solutions would not be cheap. Examples of some related costs are:

- o Production costs average $275-$300 per broadcast hour, not including teacher salaries, graphics production, student or teacher materials, etc.

- o Course development costs in other states have ranged from $175,000 to $1.5 million, per course. Even if existing sources are utilized and only translated into new technological formats (e.g., regular textbook materials into microcomputer software) expenditures would be about $120,000 per course.

- o Satellite uplink time costs would depend on whether CSU could buy any additional time on the National Technological University transponder at their "preferred customer rate" of $425 per hour. Otherwise, the "non-preferred customer rate" would run from $600 to $700 per hour.

KRMA-TV: Channel 6 is currently broadcasting a great deal of quality instructional television, but funding difficulties at the Denver Public Schools (their license holder) raise serious concerns about the future. Cost estimates to merely preserve that portion of KRMA funding currently subsidized by DPS total in excess of $1.5 million. Additional instructional programming hours could be obtained by providing funding for KRMA to broad-

cast during the hours of midnight to 6:00 a.m., when the station is now off the air. The estimated cost for additional staff, operating costs, and equipment would total $150,000. This estimate does not include expenses related to development of additional instructional courses. KRMA's reception capabilities could also be expanded by providing them with satellite uplink equipment. This would be a one-time expenditure of approximately $225,000.

RECOMMENDATION: CDE should seek funding to assure continuation of KRMA's instructional programming. The amount required to continue KRMA's programming is miniscule when compared with the expenditures that would be needed to replicate KRMA if its services were allowed to lapse.

RECOMMENDATION: CDE should seek funding to obtain satellite uplink capabilities for KRMA-TV. This will greatly increase their potential service area and assure better reception in mountainous parts of the state.

Instruction by Satellite Programs (OSU, TI-IN, and Utah): All of these programs require satellite downlink equipment, costing from $5,500 to $15,000. The OSU German course and the UDE Spanish classes require microcomputers with special voice synthesizer software. In addition to standard microcomputer expenses, the synthesizer costs approximately $900 per machine. Student and teacher materials, electronic mail services, and other costs would be in addition to equipment charges.

Each of these programs charges a flat fee for access to the network, plus additional charges depending on the number of students taking the course, the variety of courses being offered and other factors. These costs can run from $1,700 per receive site for one course, up to $6,600 per site for a large number of courses. Certainly, these figures compare favorably against the cost of hiring a certified teacher. Many small schools couldn't afford to hire a teacher, even if one were available, because of the small number of students needing such specialized classes as foreign languages, higher math, and advanced science.

RECOMMENDATION: CDE should seek funding to provide satellite access to small schools. Satellite instruction is a good way to provide foreign language, higher math, and advanced science classes to rural schools, but many small schools cannot afford the initial costs of satellite reception equipment.

State Microwave System:

The contractor discussed the advantages and disadvantages of using this backbone network with a number of state administrators. There are certainly differences of opinion as to the reliability of this system, but almost everyone contacted by the contractor agreed that long distance phone rates could be cut from 40% to 60% by using this technology.

After considerable analysis of the conflicting reports concerning the state microwave system, the contractor has come to the following conclusions:

o Significant cost savings can be gained by public agencies by using the state microwave system to transmit data. Utilization of this system would have to be through the Department of Education, since the Division of Telecommunications only deals with other state agencies.

o The microwave system is not subject to breakdowns any more frequently than Bell lines.

o Problems seem to appear when comparisons are made between the time it takes to have repairs made in Bell lines versus the state microwave system.

- State agencies reported that Bell repaired most outages within 2 to 4 hours, but 10% of the outages required a down-time of 6 to 8 hours.

- State agencies reported that Division of Telecommunications repaired most outages within 4 to 6 hours, but 10% of the outages required a down-time of 1 to 1 1/2 days.

- State administrators surveyed felt that delays in repair work by the Division of Telecommunications were cause by two factors: lack of adequate staff to deal with outages in a timely manner, and lack of the latest technology in network control devices to locate the cause of problems, which lead to further delays.

o Agencies that do not have a great deal of time-urgent data to transmit can make significant savings by utilizing the state microwave system. Even those agencies that have some urgent data transmission needs, can develop back-up systems, such as phone dial-up systems in the rare instances that a lengthy outage occurs.

RECOMMENDATION: The Department of Education should consider its data transmission needs and those of local schools and libraries in light of cost savings that can be attained by using the state microwave system.

RECOMMENDATION: If CDE, or a large number of local schools and libraries, wish to utilize the state microwave system for data transmission, consideration should be given to finding alternative systems to use when there are microwave outages.

RECOMMENDATION: CDE's Director of Telecommunications should confer with the Director of the Division of Telecommunications to determine if a joint request for additional staff to service state microwave outages would make use of the backbone system more reliable for CDE, schools, and libraries.

Colorado Advanced Technology Institute (CATI):

Efforts are underway by this group to improve Colorado's economy by a high technology partnership between business and higher education. Investigations should be undertaken to determine the interest of expanding this program to include K-12 instruction. Could an institute be initiated in the area of instructional telecommunications for elementary and secondary education? Could an institute be initiated to train teachers and adminis-

trators in utilizing technology more effectively in education?

The contractor did not explore this option in depth because of the upcoming gubernatorial race. (Emphasis on CATI could change under another Governor.) After the election, the State Board of Education or Commissioner should pursue this issue further.

OTHER SOURCES OF FUNDING:

Although many state legislators are sensitive to the issue of educational and informational equity, the state's economy is in the doldrums. Therefore, the State Board of Education and Commissioner should take a leadership role in seeking alternate sources of funding for network implementation.

Business and Industry:

Several corporations doing business in the technology or telecommunications area were contacted by the contractor to ascertain their interest in funding educational projects. The current Colorado business climate caused them to admit that they would be more cautious in making a commitment than they have been in the past. However, the response was generally that they would be happy to consider a specific proposal when one was available, but could make no general commitments.

Another area that was explored with corporations was provision of equipment to pilot or demonstration projects. This had appeal, especially if the pilot project caused other schools to want to adopt the program and buy the equipment.

Joint Ventures: The Department of Education may want to check with the Attorney General's office regarding the constitutional prohibition of joint ventures with for-profit companies. This would appear to eliminate the possibility of a development project similar to the Spanish course which was created jointly by the Utah Department of Education, IBM, and Bonneville International.

RECOMMENDATION: CDE should explore with the Attorney General's Office ways in which state-private sector programs can be established that do not violate the Constitutional prohibition against joint ventures. Such avenues as not-for-profit corporations or demonstration projects are two possibilities that should be explored.

Executive Loan Programs: Several corporations were contacted by the contractor in regard to executive loan programs. Some companies are cutting existing staff and do not have executives available for loan. Others, especially those trying to motivate administrators to take early retirement, were interested in the matter further with CDE. An executive who needs only one more year to qualify for an early retirement plan could see assignment to CDE as an opportunity to explore post-retirement options.

Executive loan programs can be of short or long duration. The longest period mentioned by a corporation was one year. Not all companies were

willing to pay the executive's full salary; some mentioned the need for CDE to come up with a 50-50 match.

Aside from cost factors, the Department should examine an executive's credentials carefully before agreeing to a loan program. Some company's are rumored to use programs of this type to hide "dead-wood" employees that they don't want to bother terminating. Another consideration, especially if the executive works for a technology or telecommunications company, is whether the advice given to CDE, school districts, and libraries will be completely objective or will be colored by the views of his employer.

Equipment Gifts or Loans: The State of Utah has been fortunate in its joint venture with IBM to obtain 179 IBM-PC's on two-year loan. Probably, IBM will make the equipment available for low cost at the end of the project, or might even give them to Utah schools. However, it should be remembered that Utah spend a great deal of time and money developing a Spanish course to which IBM has received exclusive marketing rights.

The contractor contacted several vendors of microcomputer hardware to inquire about gifts or loans. Answers tended to group into two categories:

1.) If Colorado can come up with an exciting joint venture, the company might be willing to lend or give equipment for project development purposes. Obviously, it will be difficult to propose a marketable idea that has not already been developed elsewhere.

2.) Some vendors had obsolete equipment in their warehouses that they were willing to give to CDE, local schools, or libraries. The problem with gifts of this sort is that maintenance can be difficult and expensive, and purchase of necessary software and peripherals can cost as much as savings made by the gift.

Television Stations: Several commercial TV stations indicated an interest in working with CDE on telecommunications issues. Potential use of KUNC's NewStar equipment is detailed in the Instruction section. A cooperative program with one or more television stations to develop a series of public service announcements is discussed in the Implementation section.

RECOMMENDATION: The State Board of Education should host a meeting of major Colorado corporations doing business in the telecommunications and technology field. Purpose of the meeting should be to introduce the business community to the Telecommunications Study and solicit specific ways in which they could be supportive. [Repeated from State Board of Education recommendations.]

Foundations:

A recent issue of the Denver Post identified 11 major foundations based in Colorado. During 1985, these organizations distributed a total of $24,285,405. All of these foundations listed "education", "children", or "youth" as eligible recipients. A dynamic project that had statewide appeal should be of interest to Colorado philanthropies. A proposal would be strengthened if it could be submitted by the Department of Education on

behalf of all Colorado school districts or libraries.

RECOMMENDATION: The State Board and Commissioner of Education should use the influence of their positions to tap funding from state and regional foundations. Foundation support can be one way to overcome the need for seeking large amounts of funding from state and federal sources. [Repeated from State Board of Education recommendations.]

Cash Funding:

Some other states have developed educational telecommunications programs that have become self-supporting. The Association for Higher Education in the Dallas/Fort Worth metroplex brokers professional education courses for business and industry, as well as for local colleges and universities. This could be explored as a model of how a self-sustaining program can be developed. Even with a program such as that operated by AHE, certain front-end costs must be provided before the project can attain the critical mass needed to attract enough users to pay its own way.

CDE could broker access to software programs such as is being done in programs in Maryland and West Virginia. In these instances, the state agency keeps a small fee to cover administrative costs.

Consortia:

Educational telecommunications project directors in Nebraska, Oklahoma, and Utah expressed an interested in forming a Mountain Plains or national consortium whereby volume discounts could be obtained on equipment, and educational technology programs could be exchanged. This topic would be a likely point of discussion at the meeting of western Chief State School Officers detailed in the Colorado Department of Education section of this Study.

The Maryland Commissioner of Education is leading an effort to form a national consortium for the purpose of buying the rights to microcomputer software and transmitting it to participating state departments of education. Each member state would then have the right to sell or give these programs to their school districts. The CDE Director of Telecommunications should be directed to obtain the latest information on development of this network and make appropriate recommendations to the CDE Executive Committee.

COST ANALYSIS

Projected costs are indicated below for several components of a statewide educational telecommunications network. All projections are estimates because of variables such as: phone line charges, satellite delivery and installation costs, possibility of obtaining group discounts, etc.

KRMA-TV:

Continue Present Programming:

$1,833,200	Total costs for instructional programming
- 340,000	Current educational television appropriation
$1,493,200	Amount needed to continue KRMA instructional television (8:00 a.m. to 3:00 p.m./Monday - Friday)

Satellite Uplink:

$ 225,000*	Estimate for equipment and installation needed to provide KRMA the ability to uplink signal to a satellite

Additional programming costs, as outlined below, would have to be added to estimate cost of actual instructional via satellite costs.

Additional Programming Time:

$ 150,000 Production costs for midnight-6:00a.m. broadcasting

Does not include the following costs:

Course development, including student and teacher materials

Software development, if needed

Teacher salaries, including instruction, grading tests, and training for classroom personnel

* One-time costs/all other costs are recurring annual expenses.

Colorado State University:

Projected cost to provide instructional programming. Estimate is based on a one-hour course taught for 180 school days. Additional expenses would have to factored in for training of person administering class at local school.

$101,700	Transponder time at $565 per hour (CSU estimated cost at $425 to $700 per hour)
49,500	Production costs at $275 per hour (CSU estimated cost at $275 to $300 per hour)
30,000	Teacher salary (part-time) and graduate students for grading tests; would have to be increased if conversational practice needed with a foreign language
105,000*	Development of student and teacher materials (Based on experience of other states, costs could run from $10,000 to over $200,000)
10,000	Miscellaneous, including electronic mail, postage, 800 number, etc.)
$296,200	Total cost of one course for one year

* One-time cost; recurring annual costs are $191,200

Instruction Via Satellite:

Program Initiation Costs:

Costs are estimated per-building; a district having more than one building would need to duplicate most prices given here. Prices will differ slightly depending on which vendor is chosen. Also, schools already owning some of the needed equipment can reduce their initial costs accordingly.

$9,000 to $15,000	Initial cost to offer one course for one year (8 to 10 students taking course at one site)

*Approximately $7,000 to $10,000 are one-time costs such as: satellite purchase and installation; microcomputer hardware and software purchase, phone line installation, etc.

Recurring annual costs would be approximately $2,000 to $5,000 per course, per building.

Satellite Access for Small Schools:

$2,579,500*	Appropriation of $5,500 to all schools (469) with an enrollment of 300 students or less
$ 764,500*	Appropriation of $5,500 to all high schools (139) with an enrollment of 300 students or fewer

*One-time costs

Electronic Mail and Bulletin Board System at CDE:

Estimate is predicated on the following assumptions:

- o Some staff already have microcomputers which could be adapted to access the network
- o Some staff only need or desire simple equipment to access the network
- o Access to the Department's computer can be via dial-up access for most staff
- o Staffing level at CDE estimated to be 200

200	staff at CDE
- 21	existing HP terminals (hardwired)
179	staff requiring hardware or software to access system

$90,000*	Staff (60) needing microcomputer access to system at cost of $1,500 per person
75,000*	Staff (60) needing only terminal with programmable function keys and modem to access system at cost of $1,250 per person
16,500*	Staff (60) using existing microcomputers to access system with terminal emulation software at cost of $325 per person
50,000*	Adapt HP3000 to handle increase access load (Assume that most microcomputers/terminal will utilize dial-up access. Investigate sophisticated sophisticated multiplexers that other state agencies have used for this purpose.)
$231,500	Total cost
$115,750	State capital outlay funds needed. (Assume that federally funded programs would follow CDE practice and pay for their access with federal funds.

*One-time costs

NOTE: Modems may not need to be purchased if data communications system within building is adequate.

INSTRUCTIONAL DELIVERY

The most exciting aspect about educational telecommunciations is its ability to deliver needed instruction to geographically isolated students. But it can also be used to present specialized courses (e.g., Japanese) to students in densely populated areas. Educational decision makers need to analyze the broad range of courses available and select those most able to address local needs.

Technology needs to be used both to supplement and to provide the basic curriculum. Microcomputers have at least three potential uses in instruction: computer literacy, computer assisted instruction (CAI), and teaching via computers. Also, computers are being used in combination with a variety of other technologies, such as satellite instruction, audio conferencing, and video tapes.

MEETING EDUCATIONAL NEEDS:

A number of educational needs can be met by telecommunications. These include:

Equity: This is a real issue at the high school level in remote areas. Increased demands for foreign languages, higher mathematics, and advanced science have placed increased burdens on small schools. A strong relationship exists between this need and the capability of telcommunications to provide instruction.

Minority students: Educational technology can also meet the needs of minority groups: literacy (especially to help illiterate parents assist their children's education), English as a second language, presenting minorities as mentors or role models in dealing with the minority drop-out rate, and adult basic education. How can telcommunications play an important role in this arena? Because it provides a non-critical teacher. This concept of a non-critical teacher is important because a student working with a video or audio tape or a microcomputer can go over the lesson as many times as necessary. No one will know how long it takes for the student to grasp the lesson being taught. No one will call the student "dumb", or "slow", or other judgemental terms.

Special education: For the disabled, too, educational technology provides different ways of presenting instruction--ways that may be easier for the student to grasp. Once again, the non-critical teacher concept will be helpful with the handicapped.

Teacher shortages: Supply problems already exist in rural districts in regard to science, math, and foreign language teachers. Predictions are that these shortages will spread to larger districts and to other areas of the curriculum such as home economics, vocational education, guidance counselors, media specialists, etc.

In order to meet educational needs more effectively, schools need to overcome the "buy it now; we'll figure out what to do with it later" syndrome.

The number of video cameras in school equipment closets is mute testimony to the prevalence of this philosophy in the recent past. Instructional technology use must include the following three components:

1.) Purchase of hardware and software that are designed to meet the educational goals of that particular district. Consideration should also be given to desired or needed compatibility with other schools in the region.

2.) Staff training on computer hardware and software should be initial and ongoing. It is not possible to teach everything one would need to know in a single session. A certain amount of hands-on experience is necessary before moving on to the next plateau of instruction. Also, provisions must be made to train new employees and increase the skill levels of existing staff.

3.) Integration of educational technology into the day-to-day activities of the school is the real test of whether #1 and #2 above were effective. Users should turn to automation with the same degree of confidence as they approach the old pen and paper alternatives.

RECOMMENDATION: CDE should assist school districts and libraries in developing telecommunications implementation plans. These plans should address strategies whereby local agencies will implement recommendations in the Telecommunications Study that meet local needs.

USE OF TELECOMMUNICATIONS BY RURAL SCHOOLS:

Daryl Hobbs, Professor of Rural Sociology, University of Missouri at Columbia, mentions the variety of factors moving rural schools to investigate technology as a solution to their problems. Hobbs notes: "Like urban schools, rural schools can benefit from incremental refinements to their curriculum that new technologies are producing, yet beyond that rural schools differ in that they need entire additions to their curriculum — whole chunks provided in non-traditional ways."

Hobbs even predicts that rural schools may lead the way in innovative uses of educational techology. His premise is that the smallness of rural schools provides them the flexibility to develop innovative responses to technology. Rural schools also have a problem in providing the breadth of coursework demanded today; thus, they have a high motivation level to find creative solutions through technology.

Colorado must assure that poor schools—whether rural or not—have access to educational technology for administrative and instructional purposes. Sally Banks Zakariya, writing in the American School Board Journal, pointed out: "In school (as elsewhere) the rich get computers; the poor get poorer." We must view technology as a means of decreasing the disparity between rich and poor school districts, not increasing it.

Professor Hobbs feels that microcomputers will be used by educators more for communication than for calculation. He says: "When thinking about the range of potential uses of microcomputers, whether or not they represent an

educational innovation depends more on how they are used, than whether there are any present in the school."

RECOMMENDATION: Small or rural elementary or middle schools in Colorado that cannot afford to hire specialized teachers should consider using microcomputer instruction for enrichment, supplemental, or remedial education. For example, software is available for such subject areas as: meteorology, geography, vocabulary building, and remedial reading.

INSTRUCTION VIA BROADCAST TELEVISION:

KRMA-TV:

KRMA-TV, Channel 6, began broadcasting in 1956 with two hours of educational programming. The station now offers K-12 instruction from 8:00 a.m. to 3:00 p.m., Monday through Friday. Over 90 cable companies and 65 translators carry KRMA's signal to communities too remote to receive the broadcast. During the 1985-86 school year, 125 school districts utilized the 87 series and 1,472 individual programs offered by KRMA-TV.

Teachers in schools that use KRMA courses are polled regarding the effectiveness of existing classes and unmet needs. An instructional television schedule book is distributed to all participating schools in late summer. Teachers may request instructional guides for all series. Further assistance is available from KRMA's Department of Learning Services, which provides consultative assistance and workshops. Additional help is provided via a quarterly newsletter devoted entirely to instructional TV.

KRMA also provides summer school programming in senior high school subjects. Approximately 2,000 students utilized this program during the summer of 1986. The cost of summer school via television is particularly cost-effective. The Phi Delta Kappan reported in November, 1984, that the average per pupil cost of summer school instruction was $400 to $600; KRMA's costs were about $40 per student.

The Denver Public Schools have held the license for KRMA since its inception. However, they have notified the station management that budgetary considerationa have caused them to petition the Federal Communications Commission to transfer this responsibility to KRMA's fund-raising organization.

RECOMMENDATION: CDE should seek funding to assure continuation of KRMA's instructional programming. The amount required to continue KRMA's programming is miniscule when compared with the expenditures that would be needed to replicate KRMA if its service were allowed to lapse. [Repeated from the Funding section.]

RECOMMENDATION: CDE should seek funding to obtain satellite uplink capabilities for KRMA-TV. This will greatly increase their potential service area and assure better reception in mountainous parts of the state. [Repeated from the Funding section.]

RECOMMENDATION: CDE should explore with KRMA-TV the possibility of using early morning hours (midnight to 6:00 a.m.) for production and transmission of programs that could be recorded and used by schools and libraries at a later time.

KTSC-TV:

KTSC-TV in Pueblo provides six hours of instructional television per day and 30 hours per week to 58 school districts in eastern, southeastern and southern Colorado. They also broadcast some general programming of an instructional nature (e.g., "Reading Rainbow") during the summer months. Elementary school telecasting occurs from 8:00 a.m. to noon, Monday through Friday. KTSC is piloting a new plan this year whereby they broadcast high school series from midnight to 2:00 a.m. every weekday for recording and later use.

Since, 1977, the station has had a Council of Educators to provide advice and input regarding programming. The council meets three times a year and selects series and programs for the next year. Decisions on future programming are based on a user survey of all member schools.

KTSC has satellite downlink capabilities, and about 20% of their broadcasts are direct satellite feeds. Programs are also recorded off the satellite for later broadcast. The station does no original programming.

Their total budget amounts to $1.4 million, of which approximately $100,00 is the state appropriation for education television and another $210,000 is state funding from the University of Southern Colorado's budget. The remaining funds are acquired via fund-raising activities.

INSTRUCTION VIA SATELLITE:

In less than two years, instruction by satellite has gone from dream to reality. Three organizations have developed and marketed a wide variety of courses using satellites as the means of delivery. The three educational satellite vendors are: Accelerated Learning of Spanish offered by the Utah Department of Education; Public Schools Teleconference Series sponsored by the College of Arts and Sciences of Oklahoma State University; and the TI-IN Network, a company transmitting from San Antonio, Texas.

The response to instruction by satellite has been truly amazing. The above mentioned vendors now beam their programs to over 200 schools in 13 states. They estimate that over 2,300 students received their programs during the 1985-86 school year. All three vendors predicted expanded registrations for the 1986-87 school. Both OSU and TI-IN have expanded their course offerings for the current school year; Utah is exploring additional class offerings in 1987-88.

Oklahoma State University:

Their instruction by satellite began during the 1983-84 school year when they beamed science enrichment programs to 21 Oklahoma high schools. This was followed by a pilot project with Beaver High School in the Oklahoma

Panhandle offering German by satellite. This experiment was so successful that OSU began offering German I to over 50 high schools during the 1985-86 school year. The German I program was so well received that it has been expanded to include German II and Physics in 1986-87. OSU is exploring the addition of courses in higher math, advanced science, and other foreign languages for future years.

Utah Department of Education: This project is a joint venture between the Utah Department of Education and two for-profit companies: Bonneville International and IBM. Utah holds the copyright, and IBM has exclusive marketing rights. This relationship with IBM meant that 179 IBM microcomputers were loaned to Utah schools for the first year of the project. IBM has just announced that the loan will continue for the program's second year. IBM also provided technical training to participating teachers and aides.

In addition to providing microcomputers, IBM donated $120,000 in up-front costs. The State of Utah appropriated $220,000 and the Utah Department of Education committed extensive staff time to development of the course. Bonneville International, Inc. donated studio time and uplink time. The project director estimates that total origination costs were $1.5 million for the first year.

In all, almost 850 students in 30 schools took part in the program during the 1985-86 school year. This included 27 schools (in 13 districts) in Utah, 1 school in Colorado (Olathe), 1 school in Nevada, and 1 school in Arkansas. Approximately 90 of the participants were elementary school children in three different schools in Utah.

Comparisons of the Oklahoma and Utah Programs:

The Utah and Oklahoma programs have many similarities and some subtle differences. Utah has stressed a multi-cultural approach, including film clips of trips to a variety of places in Mexico. Attention is given to food, art, music, and other components of Spanish culture. The Utah program was developed by a large team of instructional design specialists. OSU's German program is the same course that Professor Harry Wohlert teaches to his college students. Oklahoma's broadcast is live, while Utah's is video taped. Utah transmits its programming every day, but OSU only broadcasts two days a week. Both programs utilize voice synthesizers to check pronunciation, and both utilize microcomputer software for drill and independent student work.

TI-IN:

This Texas project began as the Texas Interactive Instructional Network in fall, 1985. The program originated in the Texas Region 20 Educational Service Center in San Antonio because of the availability of uplink and studio facilities at that site. Instructional programming is transmitted five days a week using one-way video with interactive two-way audio for student communication with the teacher. Because of the full-time instruction, no computer assisted instruction or other learning technologies are used in the program. TI-IN teachers do use slides, video tapes, and graphics in their teaching.

TI-IN offers the largest number of satellite instruction classes of any network. They are offering the following courses during the 1986-87 school year: computer math, research and technical writing, trigonometry, physics, algebra II, Spanish I and II, computer science, personal business management, French I and II, German I and II, art history and appreciation, psychology/sociology, English IV honors, and calculus honors.

Comparison of TI-IN, Okalhoma, and Utah Programs:

One significant difference exists between the TI-IN classes and those offered by Utah and Oklahoma: TI-IN seeks to replicate the conventional classroom model as closely as possible. There is no computer assisted instruction, little structured time for independent work by students, or use of video tapes or films to supplement the teacher. These comments are not meant as criticism of the TI-IN network. In fact, one observer of the Texas education scene has attributed TI-IN's success to its perpetuation of a familiar teaching model, thus helping to overcome psychological barriers.

TI-IN transmits programming five days a week composed of one-way video and two-way audio. OSU transmits its German programs two days a week and its physics course three days a week. Utah provided live satellite broadcasts during the 1985-86 school year, but this year they plan to transmit only video tapes rather than live programming. The decision to make this change was caused by problems in spreading the instruction into the exact amount of time allocated for the broadcast. (Sometimes the teacher went over the time allocation; sometimes the teacher finished early.)

In assessing the relative merits of the Utah, Oklahoma, and Texas projects, the contractor feels that introduction of computer assisted instruction and development of independent study skills that mark the Utah and OSU programs are important components which should be considered by educators. However, the number of satisfied users of the TI-IN network attest to the adage that "the old ways are the best ways".

Evaluations of Instructional Satellite Courses:

Utah: The Utah Department of Education contracted with the Wasatch Institute of Research and Evaluation to conduct an extensive evaluation of its Spanish program at the end of the first year (1984-85). This study indicated that complete revision was needed to address problems in scope and sequencing. This revision took place during the summer of 1986 at a cost of $210,000.

Utah project evaluators found a very high percentage of student time on task. One interesting outcome of the evaluation dealt with the training--or lack thereof--of the "classroom manager". Four different types of persons were employed by schools using the Utah Spanish program: certificated teachers who spoke Spanish, certificated teachers who did not speak Spanish, aides who spoke Spanish, and aides who did not speak Spanish. At first, students in classes where the "classroom manager" spoke Spanish progressed more rapidly. But, final test scores showed no significant difference in student achievement.

Oklahoma: The Oklahoma Department of Education conducted an informal evaluation of the pilot project which operated during the 1984-85 school year. This evaluation report has not been released. During the 1985-86 school year, an informal evaluation was conducted of the 47 school districts participating in the German by Satellite program. The Oklahoma Department of Education has informed the contractor that this report is private and will not be released.

A formal evaluation of both the German by Satellite and the Physics by Satellite programs is being considered for the current school year. A decision has not been made as to whether results of that study will be released.

TI-IN: Bruce Barker from the College of Education at Texas Tech University conducted an evaluation of the TI-IN project. He surveyed 31 Texas schools participating in the program during the 1985-86 school year. In addition to receiving responses from administrators at each school, Professor Barker also surveyed 159 students. Results of his research will be made public in October, 1986, but he has released the following preliminary findings to the author of this Study:

- o The mean Average Daily Attendance was 239 students per high school
- o The average satellite class was composed of 8 or 9 students
- o Almost all schools planned to re-subscribe to the programs during the 1986-87 year.

Other survey results related to the perceived degree of difficulty of the satellite courses were: 24% of the students felt the classes were of the same difficulty as their regular classes, while 65% felt they were more difficult. Probably the most interesting finding was that 70% of the students surveyed said that, given a choice, they preferred the regular classroom to satellite instruction.

The Texas Education Agency (state department of education) also conducted an evaluation mid-term exam results for the 1985-86 school year. Comparisons were made between TI-IN students and students taking the same courses in a regular classroom setting. That report is scheduled to be released in November, 1986.

Pamela Pease, Research Director of the TI-IN Network, is completing an evaluation of the 1985-86 school year. She sought to establish baseline data prior to network implementation. This information will be compared with mid-semester, mid-year, and year-end data collection. In addition to charting student achievement, Pease's study examines four separate areas:

- o Motivation: How do students feel about using the system and why did decision-makers select the system?
- o Expections: Did the system meet student and administrator expections as to what it would provide?

o Course satisfaction: How did students feel about the program after being involved in it?

o Demographic characteristics: Do any differences exist among users of the system because of sex, age, technical sophistication, etc.?

Findings do not differ markedly from those in the Barker study. For example, in both studies students indicated that classes via TI-IN were more demanding than classes in a regular classroom setting. But, there were some interesting differences: the Barker survey revealed that 70% of students preferred a regular classroom to a TI-IN course; the Pease evaluation reported that 75% of students would take another TI-IN course if available. Perhaps, the apparent difference can be attributed to the fact that many students enrolled in TI-IN classes had no choice, since satellite instruction was the only way they could obtain the classes they needed.

Colorado State University:

CSU has been providing instruction to Colorado business and industry via video tapes since 1967. In 1985 CSU began participation in the National Technological University (NTU). This consortium uses the G-Star satellite which contains 17 transponders. NTU leases one of the transponders for member use. NTU has 21 institutional members, but only seven of them have uplink capabilities. CSU and the University of South Carolina provide uplinking of programs for all other members.

CSU used one channel on the NTU transponder last year and plans to use two channels during the 1986-87 academic year. Both channels will be busy with NTU transmissions , but there could be from two to eight hours available for potential K-12 or teacher education programming. The amount of time actually available will depend on how much is taken by CSU activities. Hence, CDE should make its desires known to CSU as soon as possible.

CSU is also currently participating in a Kellogg Grant "to develop a research and pilot program to extend higher education and state library resources to rural communities by means of technology." The Colorado State Library is also participating in this project, along with the public libraries in Craig and Meeker.

RECOMMENDATION: The Director of Telecommunications should work with Colorado State University to clarify what role CSU could or should play in satellite transmission of instructional programming to Colorado's elementary and secondary schools. Decisions may be dependent on what role is delineated for CSU in the area of teacher education via telecommunications. Also, the Colorado Commission on Higher Education should be asked to clarify and expand on their identification of CSU as the telecommunications leader in higher education.

Commercial Satellite Programming:

Many programs being broadcast by commercial satellites and offered by cable companies are educational in nature and could be used in a school setting. Interested parties should consult with their local cable companies regarding

availability of these programs in their area. Some of the more significant ones are listed below.

Alpha Repertoire Television System (ARTS)

Black Entertainment Television (BET)

LIFETIME

Cable News Network (CNN)

C-SPAN (Cable Satellite Public Affairs Network)

Financial News Network (FNN)

Galavision (division of SIN National Spanish Network)

Spanish International Network (SIN)

TeleFrance USA

The Weather Channel

TCTV (French Canadian)

THE USE OF AUDIO CONFERENCING FOR INSTRUCTION:

Use of satellites to deliver instructional programming has caught the attention of the educational community because it is glamorous and high tech. However, there are many other effective and cost-efficient ways to deliver instruction to students. One method that has been highly successful is audio conferencing. This includes the use of interactive audio to create a conversation between the teacher and remote students. The process can be combined with microcomputers (computer assisted instruction, electronic blackboard, electronic mail, etc.), workbooks, video tapes, slow scan television or other learning resources.

Isaac Asimov commented recently: "You may believe that few people have the necessary equipment and know-how for computer conferencing, but already there are about 19 million personal computers in the United States, one-fifth of which [3,800,000] are adapted for conference work, and 9 million more personal computers in other countries. By 1990 the total number worldwide may be in excess of 120 million, with a large percentage adapted for conference work. The net result will be a class that can be worldwide, not based on students listening to a teacher but on people carrying on global discussion."

Some promising instruction by audio conferencing programs across the country are:

CESA #4 Teleconference Network:

The Cooperative Educational Service Agency, #4, located in La Crosse, Wisconsin, has utilized audio conferencing for foreign language instruction

for the past seven years. They have compared student achievement in the audio conferencing classes with students in a regular classroom. The difference in achievement is only 1%. In the evenings, the network is used for social studies and English classes for adults who only need one or both credits to graduate from high school. They are currently exploring combining this phone network with telefacsimile machines in order to teach Japanese and math. The system uses four-wire dedicated phone lines with a speaker. Four microphones are connected to the speaker to permit conversation over the line.

Inservice training for teachers and administrators is also provided by CESA #4. University credit courses are offered along with discussion sessions among teachers from different schools. This informal exchange of information is especially valuable for educational specialists such as guidance counselors, band directors, school librarians, and other who often have no colleagues within their school to share teaching strategies, discuss problem solving, or explore new techniques.

Utah's Tele-Learning Project:

The Garfield County School District, in Panguitch, Utah, received a grant from the Utah Department of Education in 1983 to create a tele-learning network. The project combined audio conferencing with an electronic blackboard to bring trigonometry to four small high schools in Garfield County. During the 1984-85 school year, the program was expanded to include physics, Advanced Placement English, art, and Advanced Placement American history. Courses offered during the 1985-86 school year were: trigonometry, physics, Advanced Placement English, and art. Mansfield College in Mansfield, Pennsylvania, replicated the Tele-learning Project for small schools in the northern portion of that state and in southern New York State.

Comparison of Interactive Video and Audio Conferencing:

One question that arises among educators when audio conferencing is mentioned as a means of instruction relates to whether interactive video is more effective than interactive audio. Dr. Henry E. Jolley, former Superintendent of Schools in Panguitch, Utah told the contractor of this Study: "Audio is the critical element because that provides the interaction between teacher and student. You can get around the need for video by using an electronic blackboard, but you can't do without interactive audio." He feels that video has a disadvantage: The teacher never relinquishes responsibility for teaching; hence, tele-learning causes the student to assume more responsibility. A brochure printed by the project states: "In many ways this new emphasis on students assuming the responsibility for their own learning is as important as the learning itself. Students try harder, learn more, and are much better prepared for college when they learn to become more self sustaining in their quest for knowledge."

Not all educators will agree with Dr. Jolley about the advantages of audio conferencing. However, this technology is so much cheaper than either direct broadcast or satellite transmission, that it should be considered by districts that cannot find the fiscal resources for video instruction.

OTHER EDUCATIONAL TECHNOLOGIES

Some other delivery systems may be just as effective as satellite instruction. Certainly, many of them are less expensive and should be considered as supplements or alternatives to satellite delivery of coursework. Other technologies are just emerging and appear to hold promise for education. Some new technologies are not yet cost effective, but will be in the near future. These technologies should be carefully tracked by the Colorado Department of Education by monitoring specialized professional publications. The newly released CD-ROM Review is one such publication. Many emerging technologies were developed for business and industry and little thought has been given to their instructional potential.

Many adults can recall when the purchase of a television set was a major financial commitment. Now, they are so inexpensive that many households have three or more TV's. Also, in the 1950's there were very few television channels, so the choice of programming was limited. The same situation exists for instructional programming on some new technologies. Schools have the option of waiting until sufficient materials are available or moving into new areas of technology in the anticipation that additional software will be written.

Compact Disc-Read Only Memory (CD-ROM):

All of the inhibiting factors attributed to early television are true of the present CD-ROM market. Currently, the equipment is expensive, software is limited, and original programming is costly and time consuming because there are presently only two mastering facilities in the United States. Within the next 3 to 5 years, all of this will change. A recent international conference on CD-ROM technology was entitled "The New Papyrus". If compact discs can live up to their potential, comparing them with the discovery of papyrus may not be an exaggeration.

The compact audio disc has been more successful than its sophisticated cousin the CD-ROM. If the audio discs are any indication, costs of CD-ROM's will go down dramatically as demand--and sales--increase. The very configuration of the CD-ROM gives some indication of its capacity to impact the educational field: A single 5 inch disc can store 550 megabytes of data, which is the equivalent of 1,500 floppy disks. Translated into printed matter, one compact disc equals 250,000 pages; that is the equivalent of approximately 500 books. Because of its random access capabilities, the CD-ROM can locate any bit of information on any of those 250,000 pages in a matter of seconds.

A good example of the growing CD-ROM market is Grolier's Academic American Encyclopedia, which is now available on CD-ROM for $199.95. Another interesting feature is a complete updating of the CD-ROM's information for $24.95 annually.

Announcement has just been made that the ERIC database, which provides access to literature in the field of education, is now available on CD-ROM. Discs can be acquired for the period from 1966 to 1975 or from 1976 to 1982. Another disc contains records from 1983 to the present; it will be

updated quarterly. The producer also supplies database indices and search software along with the discs.

Compact Disc/Interactive (CD/I):

Plans are to release this new technology by the fall or winter of 1987. It will provide the capability of utilizing a keyboard or pointing device to make a compact disc interactive. CD-ROM Review reports that CD/I will use a worldwide standard agreed to by Sony and Philips. Hence, there will be no problems of compatibility.

CD/I will provide all the benefits of a compact audio disc with the visuals of a video cassette. Initial releases of the CD/I will only handle still frame-by-frame pictures, but they will be of a high resolution quality.

Vendors indicate that CD/I will be marketed to homes, schools, and libraries, which may solve the present CD-ROM problem regarding the paucity of educational and informational software. CD-ROM Review predicts that: "CD/I has the potential to cover the entire spectrum of the general school curriculum. Science, math, history, reading, and foreign language will each have a CD/I series. One of the most common drawbacks of using computers to teach general subjects is lack of adequate audio and pictures. CD/I will solve this problem at a hardware price that will be competitive with the Apple line of computers."

Fiber Optics:

Fiber optics technology is often mentioned when technologies of the future are discussed. However, it is merely another way to transmit information; albeit a more sophisticated way. The only present educational use of fiber optics is a demonstration project covering seven school districts in Minnesota. The project was developed jointly with Tele-Systems Associates at a cost of $980,000.

RECOMMENDATION: The CDE Director of Telecommunications should track emerging telecommunications technologies that might hold promise for schools or libraries. Also, some existing systems are not now cost effective, but will be in the near future. Tracking of telecommunications should be accomplished by reading specialized professional publications and attending conferences or meetings on these topics. [Repeated from the Colorado Department of Education, Staffing, section.]

Video Tapes:

Video tapes have been available for some time, but they still have not reached their predicted potential in education. Film companies have offered their products on video tape as well as in the usual 16mm format for some time. Schools have been slow to adopt this technology even though significant savings can be made in reduced cleaning, repair, and replacement costs. Many programs broadcast over public television stations or via satellite can be legally video taped for instructional purposes. KRMA-TV in Denver paid access to the collection of 1,167 programs which were available to educational agencies with satellite downlinks from the Interregional

Telecommunications for Education Coordinating Council (I-TECC). KRMA used the tapes for their own broadcasts, but Colorado schools could have used the access negotiated by Channel 6 to take tapes directly off the satellite. Several schools in Colorado expressed an interest in the program, but none used the direct access option during the 1985-86 school year.

An interesting recent video tape product is the "Video Encyclopedia of the 20th Century", produced by the Corporation for Entertainment and Learning, Inc. This series, contained on 75 one-hour video cassettes, covers all major events of the Twentieth Century via a collection of film clips. The approach permits students to view history as if it were a series of current events. The set is completed by a five-volume index and a 2,500 page reference volume that provides background information. The $8,500 series cost may be prohibitive for small schools unless the programs can be shared through a BOCES. An abbreviated version has been recently announced that will be available soon for $1,000. This should increase the number of schools that can afford access to the series.

Microcomputers:

Many satellite or teleconferencing programs utilize microcomputers for computer assisted instruction, practice and drill, or transmission of student work to a distant teacher. There is another way in which microcomputers could be used for instruction, but this method has not been tried as far as the contractor could discover. This proposal assumes that students pursuing foreign languages, higher math, or advanced science are above average students and are highly motivated. If so, it seems that they could use one of the excellent microcomputer software packages for independent or small group study with some minimal assistance from a teacher, aide, or adult volunteer. Foreign language software could be supplmented by audio tapes to develop pronunciation skills. This proposal is not is meant to suggest that a course based solely on microcomputers would be more desirable than the highly-rated instruction by satellite classes. It is merely intended as an alternative that some schools may want to pursue.

Use of microcomputers for instruction could also be used effectively at the elementary or middle school level to provide enrichment or supplemental education. For example, microcomputer software is available for such subject areas as: meteorology, geography, famous explorers, vocabulary building, remedial reading, etc. Small schools that cannot hire a full range of teachers with specialization in different subject fields may find that such supplemental resources provide the curriculum enhancement they are seeking.

RECOMMENDATION: Colorado educators should identify situations in which students could gain as much instructionally by using one of the excellent microcomputer or CD-ROM software packages to provide independent or small group study with minimal assistance from a teacher, aide, or adult volunteer.

AREAS OF INSTRUCTION:

Foreign languages, higher mathematics, and advanced science courses are the most frequent users of educational telecommunications. This is caused by the increasing pressure schools are receiving to provide a full gamut of instructional offerings, especially to meet the needs of college-bound students. This is difficult even for large and medium-sized schools, and financially impossible for small schools. Hence, educators are turning to technology to solve these problems.

All schools should look to educational telecommunications as a means of providing a wider range of course offerings, enrichment or remediation programs , as well as specialized programming to meet individual student needs. One BOCES director indicated that his school districts would also be interested in access to courses in: economics, psychology, and sociology. He stated: "Small school districts don't have enough students to be able to offer any of these classes."

Telecommunications could also be used to offer college credit courses for high school students. These courses would not be Advanced Placement or even necessarily for gifted students. The purpose would be to permit motivated high schoolers to obtain college credit if they so desire.

Field Trips:

These could be taped or uplinked by KUNC-TV'S NewStar van. A Channel 4 executive told the contractor that KUNC's equipment is often in a part of the state where field trip-type experiences could be captured. This hasn't been done to date because educators have never asked the station for help. If a regional or national consortium were developed, a catalog of such field trips which had been recorded of video tape could be developed for sharing. (See Recommendation in the Colorado Department of Education, Administration, section suggesting that the Commissioner of Education call a meeting of Chief State School Officers to consider formation of such a consortium.)

Home Study:

From time to time, the State Board of Education has expressed concern as to whether students participating in home study courses are receiving adequate grounding in the basic skills. One way to address this, would be to require that home study students access one or more basic skills development classes via telecommunications.

Homebound Education:

Large school districts have long offered visiting teachers to provide assistance to students who are temporarily homebound because of illness or injury. A statewide telco network could be used to provide this same service to students in any part of the state.

RECOMMENDATION: The Director of Telecommunications should explore with interested school districts whether a statewide educational telecommunications network could provide homebound educational services to students in

small school districts. Large districts, that how provide visiting teachers to students who are temporarily homebound because of illness or injury, may also want to explore this alternative.

Science:

Many schools devote part of the science curriculum to a study of meteorology. This may be just an overview for junior high students, or a more detailed course for advanced high schoolers. For either group, the ROGI database provided by KUNC-TV, Channel 4 in Denver, is invaluable. A wealth of facts from the National Weather Service are available. Research on the database could be conducted as part of a regular class presentation, or students could select particular components to investigate on their own. Anyone having a modular phone, modem, and terminal or microcomputer can access the system. This means that some students would be able to even work on assignments at home. Cost to access the system is thirty cents per minute, plus standard long distance fees for schools outside the Denver/Boulder area.

Special Education:

Both Maine and Minnesota have written special education technology plans. The Maine document is especially well done and devotes a great deal of space to the importance of planning. With such a good model available, Colorado may want to recommend its adoption by special education administrative units instead of spending time on developing a Colorado plan.

One advantage in using technology with special education students is that specialized equipment has been developed that permits students with severe physical disabilities to "get out of their bodies". This can be particularly important for the gifted handicapped child. Also, learning the use of technology can improve employment possibilities for handicapped students.

During the recent Statue of Liberty Weekend, many Americans saw the IBM commercial that featured a blind, paraplegic systems analyst who had received the President's Handicapped Citizen of the Year Award. The recipient said that he hoped his children would understand that "there is more than one way to see, and more than one way to get around". His message emphasized that through technology, disabled persons can maximize their capabilities and minimize their handicaps.

RECOMMENDATION: Both Maine and Minnesota have written good special education technology plans. The Maine document, which is especially well done, emphasizes the importance of planning. With such a good model available, Colorado special educators should consider adopting it rather than developing a Colorado plan.

RECOMMENDATION: Colorado special educators should explore how technology's ability to permit the handicapped to "get out of their bodies" can be used to strengthen special education and increase employability of the handicapped.

Special Education Programs for Pre-School Children:

The TELEPAC project was designed by Utah State University to provide specialized services to rurally isolated/severely handicapped children. It was based on the premise that parents or other family members could be trained and supported to provide special education services to these students. In the face of limited technology, TELEPAC project based its delivery of services on the telephone and instructional packages. These were reinforced by a Local Program Monitor, who was a health care professional, social worker, or educator.

Use of the telephone as TELEPAC's major delivery system built on what was readily available. It consisted of IN and OUT WATS lines connecting appropriate staff in the Exceptional Child Center at Utah State University with participants. Several other services were provided by Utah State University including: development and dissemination of parent instructional packages; Parent Resource Library and Multimedia Collection which offered "how to" pamphlets, books, and audiovisual materials; training packages for parents and Local Program Monitors; and consultative assistance concerning other providers of services in the State of Utah.

How did the Parent Involvement Packages operate? An evaluation of the project reported: "Each package provides the parent with a direct instructional procedure (scripted format) for introducing and teaching an unmastered skill or concept to his child. Correction procedures and techniques for providing practice in the new skill or concept are also specified for the parent."

RECOMMENDATION: Special educators in Colorado should explore whether Colorado could replicate the TELEPAC project. This Oregon program used telecommunications to train parents of severely handicapped pre-school children.

ACCESS TO RESOURCES

Educators have always depended on learning resources to support and supplement what is taught in the classroom. This concept becomes more critical when the instructor is miles away and the local school, or even local community, does not possess the learning resources necessary to support distant curricula. A statewide educational telecommunications network can provide the means of accessing a variety of materials from within the state and across the country.

EXISTING RESOURCE AGENCIES:

Several agencies and organizations already exist to assist Colorado schools in locating, and obtaining learning resources. Many of Colorado's Boards of Cooperative Educational Services (BOCES) have cooperative film or video tape libraries. Some offer collections of professional materials, kits, special education resources, or other expensive or seldom-used items.

Colorado's Regional Library Service Systems (RLSS) are charged under state Statute with coordinating the sharing of resources among all types of publicly supported libraries in their geographic region. RLSS services differ from one region to another because they are designed to meet the needs of their area, but all offer continuing education, resource sharing, and consulting services.

The Colorado State Library(CSL), an Office within the Department of Education, offers consultative assistance to school libraries in areas ranging from automation to reading programs. CSL staff often work as a team with other CDE staff members, especially in the case of accreditation concerns or censorship problems.

The CDE Resource Center provides informational support to CDE staff and indirectly to CDE clients. The Resource Center can and should form the basis on all requests for non-human resources are organized and handled within CDE. This will free CDE staff to provide direct consultative assist-ance and not waste their time trying to locate informational resources.

The CDE Film Service offers access to a large collection of 16mm. films and some video tapes to Colorado citizens. Because the Film Service is self-supporting, a nominal charge is made for film lending.

The Bibliographical Center for Research (BCR) is a not-for-profit corporation devoted to encouraging the sharing of library services in the Mountain Plains area. In addition, they offer group discounts on microcomputer hardware and software, online database services, professional training, etc.

RECOMMENDATION: School administrators should make sure that their school districts are active members of Colorado's Regional Library Service Systems. Membership will provide access to library networking opportunities within their region, the state, and nation.

ONLINE REFERENCE DATABASES:

The National Commission on Libraries and Information Science (NCLIS) makes an annual report to the President on emerging trends and issues in library and information science. The 1985 report recommends: " A completely new approach to the school curriculum be adopted whereby children, in addition to teaching computer skills from an early age, learn to use libraries and learn how to find and use information effectively. This skill is seen as the 'fourth R' and is essential in the learning process from cradle to grave."

This viewpoint was reinforced by Dr. Jacqueline Mancall, writing in the Drexel Library Quarterly, "The rationale for providing training in how to locate information has been that students cannot be competent locators of the information they need without understanding what materials are available to them and how these materials are organized for retrieval. In order to accomplish this, students learn early in their school experience which books, magazines, and other media are available in libraries and how they are arranged. They are introduced to such conventional library tools as the card catalog and how to use it by searching under author, title, and subject. Instruction is also offered to students in the use of popular indexing tools, such as the Readers' Guide To Periodical Literature which can be used to locate pertinent magazine articles."

More and more teachers and school library/media specialists are looking at online database searching as an important learning tool for students. In order to conduct an online search, a student must learn various research methods, use problem solving skills, and develop logical thinking abilities.

BRS AND DIALOG Services:

The two major vendors of online databases, DIALOG and BRS, have identified the school market for special emphasis during the 1986-87 school year. For example, BRS will provide training, curricular materials, and technical assistance to schools wishing to offer online searching to students in grades 8 through 12. While the ERIC database is available on both DIALOG and BRS, some important educational databases are found only on BRS: Resources in Computer Education, School Practices Information File, and the Texas Education Computer Cooperative Database, which includes reviews of educational software.

DIALOG offers an educational discount program, which has been utilized mostly by graduate library schools, but the service is available to any school. For a fee of $15 per hour of connect time, DIALOG provides access to almost all of its databases; Chemical Abstracts is one of the few exceptions. The school program does not permit offline prints or permanent saving of information.

The CLASSMATE Program:

In November, 1986, DIALOG will begin offering a new program, entitled CLASSMATE, which will be even more attractive to schools. This will include a teacher's guide, masters for making overhead transparencies, and

student workbooks. The new program will also permit schools to pay a flat fee for access and know that the service will not permit expenditures over that amount with prior approval. This will permit schools to experiment with the program without incurring expenses about the base fee.

Access to Wilson Indexes:

The H. W. Wilson Company, publisher of numerous Wilson indices, including The Readers' Guide to Periodical Literature and Education Index, offers that service online. The WILSONLINE database is available for educational use at $15 per connect hour, including a tutorial program and user's manual. Wilson also offers WILSEARCH, a menu-driven software program, which is available for IBM PC's (and workalikes) and Apples. This program assists users to formulate their search strategy and select the appropriate database. Information can then be transmitted to WILSONLINE to execute the search, thereby saving online time and costs. The WILSEARCH software costs $275 if ordered directly from the H. W. Wilson Company. However, BCR offers a member discount rate of $150. (All Colorado schools and libraries are members of BCR because the State Library pays a state membership fee.)

Databases on Electronic Mail Services:

Many schools offer student access to The Source or CompuServe. These provide online access to the Academic American Encyclopedia, newswire services, and a variety of electronic bulletin boards. Both of these services would introduce students to online information sources at a lower cost than online database searching.

The InfoMaster program of Western Union's Easylink service offers access to over 700 online databases. A single language can be used to access all databases, but three levels of inquiry are provided to accommodate varying levels of research needs and searching sophistication.

Online Bulletin Boards:

Students would find the following databases valuable resources: United Press International news and business, Associated Press news, the Scripps Howard news, and The Washington Post. Stock market quotations, the National Weather Service bulletins, and the Airline Guide are examples of other online resources that can be accessed by students with a minimum of training. Many of these services are available as part of a subscription to The Source, Easylink, and other national electronic mail systems.

RECOMMENDATION: Colorado schools should explore the benefits that would accrue to their students by providing access to online information resources that are available from one of the national electronic databases.

Locating Resources Found on Databases:

Before a school considers offering database searching to its students, it needs to determine how sources found on the database will be provided. Nothing is more frustrating than receiving a number of citations from a search, only to discover that your library doesn't hold any of the titles.

The emerging Colorado Library Network will make access to resources easier for school users to obtain. However, this means a commitment by school administrators and media specialists that interlibrary loan will be utilized to get materials from other libraries. This requires time to request the materials and to return them, as well as money to pay for postage, phone calls, and packaging materials. Access to a greater variety of learning resources should certainly justify the small cost involved in ILL.

RECOMMENDATION: School districts need to assure that resources found on automated databases can be obtained. This means a commitment by school administrators and media specialists that interlibrary loan (ILL) will be utilized to obtain materials from other libraries. ILL requires staff time to request and return materials; as well as money for postage, phone calls, and packaging.

ONLINE LIBRARY CATALOGS AND NETWORKING:

If school districts want to access resources located in other libraries, they may be asked to make their holdings available to others, too. Online catalogs can be created in a variety of ways but all have two components in common. First, bibliographic records (the information contained on the library's catalog cards) must be put into machine-readable form. Secondly, machine-readable records should follow the national standards defined by the Library of Congress.

Once school library holdings are in an automated format, they can be amalgamated with records from other schools, public libraries, or community college or university libraries. These regional databases greatly expand all citizens access to informational materials. An example of one such project is the MARMOT consortium on the West Slope that combines the holdings of 2 school districts, 6 community college and universities, 7 public libraries, and 3 RLSS offices. These 18 libraries will share a common online catalog which can be accessed and shared by all their users.

RECOMMENDATION: Schools wishing to produce machine-readable records of their library holdings, should seek assistance from their Regional Library System, the Colorado State Library, or the Bibliographical Center for Research.

Networking:

Even without automation, school libraries can plan cooperatively with other library and information agencies in their town or city, county, or regional area. Such cooperation can lead to coordinated acquisition of materials and equipment at group discounts, joint planning for purchase of expensive items, shared programs such as storytelling. Taxpayers are always concerned about needless duplication; cooperative planning can reduce these problems while increasing the purchasing power of all participants.

RECOMMENDATION: School board members and administrators should take a leadership role in encouraging development of community resource plans. Such plans would include joint resource coordination among all libraries

within a city, county, or region.

Daryl Hobbs noted: "The innovation in rural education is not computers or satellites but rather networking. It is how these technologies are linked with outside sources of educational content that will likely have the greatest influence on addressing the rural education problem...."

RECOMMENDATION: School administrators should encourage their school library media specialists to stay informed about emerging trends and issues in library automation and networking on the regional, state, and national level. This knowledge will assist the school district in providing high quality learning resources to faculty and students.

TEACHER AND LIBRARIAN EDUCATION/STAFF TRAINING

Any new technology is only as effective as the people who use it on a day-to-day basis. Colorado's institutions of higher education must educate prospective teachers and librarians to use educational telecommunications effectively. In addition, current teachers, librarians, and administrators need training to make educational telecommunications work in their districts and libraries.

The Minnesota Department of Education pointed out some of the problems that educators have encountered when dealing with technology: "Even when good software was found, teachers were unable to obtain content-related inservice. Many teachers recognized the importance of technology but were unaware of or unable to visit schools where successful uses of technology were taking place."

Such fustrations make technology implementation difficult. Factors like availability of training and access to visitation sites can hasten or hinder the transition into technology and telecommunications utilization.

TEACHER CERTIFICATION AND RE-CERTIFICATION:

The Colorado Commission on Higher Education (CCHE) has established two committees to address emerging concerns about the availability of teacher education coursework and potential uses of technology for it delivery. The charges and current activities of these committees are detailed below:

Teacher Education Access Committee:

This committee was created to address concerns about the availability of training opportunities for existing and future teachers. The main focus of concern was CCHE's decision to designate the University of Northern Colorado as lead institution for teacher education, and to cut programs at several other institutions. Teachers, especially those in rural areas, became alarmed about access to necessary coursework for re-certification or addition of endorsements.

The Teacher Education Access Committee has identified three broad recommendations under which all proposals coming from that committee will be grouped. The final committee report is due to CCHE by the end of 1986. Recommendations are:

1.) CCHE should create an interim task force on teacher education to collect data regarding existing resources and capabilities, negotiate joint agreements among institutions, and determine UNC's needs to meet its increased responsibilities.

2.) CCHE should authorize and finance a statewide consortium of colleges and universities that offer teacher education courses. This consortium would build on findings of the interim task force to develop a cohesive system of statewide teacher education offerings under the leadership of UNC.

3.) CCHE should build incentives into its funding formula which would lead to implementation of the statewide consortium concept.

The Teacher Education Access Committee has also proposed that delivery sites be established in several places across Colorado. Here, a local college would offer graduate teacher education courses under the auspices of UNC. Sites being currently considered, with their college or university affiliation, are: Grand Junction (Mesa College), Gunnison (Western State College), Pueblo (University of Southern Colorado), and Denver (University of Colorado at Denver). Secondary delivery sites will also be identified as the need is identified for additional sites. Also, Adams State College in Alamosa will be offering graduate education courses under a cooperative program with UNC.

Ad Hoc Telecommunications Advisory Committee:

CCHE has appointed this committee to explore the broader question of how telecommunications can be utilized to support the programs of higher education institutions in Colorado. The issue of telecommunications utilization in higher education becomes more critical in the area of teacher education in light of CCHE's recent decision to designate the University of Northern Colorado as lead institution in teacher education, while also designating Colorado State University as lead agency in telecommunications. This means that satellite uplink capabilities are located in Fort Collins, whereas teacher training courses are being offered from Greeley. Satellite uplink equipment costs approximately $225,000, there is some question as to whether the General Assembly will appropriate funds for such capabilities at UNC. Therefore, UNC will need to work closely with CSU if teacher education by satellite is to be realized in the near future in Colorado.

The Ad Hoc Telecommunications Advisory Committee has identified the following goal to address issues of telecommunications and education:

"The primary goal of CCHE and public institutions in utilizing telecommunications should be to meet education and training needs of the people, institutions, and the economy of Colorado by making available and providing greater access to the education and learning resources of its campuses."

The committee adopted six principles for implementation of this goal:

1.) Institutions of higher education should be encouraged and supported in employing telecommunications which result in greater effectiveness, productivity, and the same or higher quality of education as that available in the regular classroom.

2.) Telecommunications planning should be an integral part of all institutional and state academic master plans, including consideration of needs, costs, and benefits. CCHE should develop, review, and approve mechanisms that encourage institutional creativity and innovation in planning and utilization of telecommunications.

3.) Colleges and universities should form one or more consortitia to coordinate use of human and technical resources.

4.) Telecommunications serves people in broad geographic areas, thus current service area policies should be modified to reflect the diffuse nature of technology.

5.) Institutions should be encouraged and supported in developing effective policies and practices which foster incentives for faculty and staff to engage in telecommunications programs while protecting rights and responsibilities of both faculty and institutions.

6.) Partnerships between government and the private sector, as well as statewide coordinated use of resources, should be promoted in order to make the financial investment required to exploit the various telecommunications technologies.

The committee plans to review successful and unsuccessful higher education projects in other states. They also plan to investigate the question of access to resources in support of instruction. The committee's final report to CCHE will be presented in December, 1986.

Consideration of This Study in Light of CCHE Committees:

Although the CDE Telecommunications Study will be completed prior to completion of both CCHE committees, findings and recommendations from these groups will be critical to implementation of certain recommendations in the CDE Study. In some ways, it is fortunate that the CDE Study will be completed first. This will enable the Department to comment on any CCHE proposals in light of CDE telecommunications goals and objectives. Since many schools want to utilize telecommunications to deliver instruction to students, it would be desirable if the same delivery modes could be used for teacher education and staff development.

RECOMMENDATION: The State Board of Education and Commissioner should closely monitor recommendations being considered by the Colorado Commission on Higher Education's Teacher Education Access Committee to ascertain how telecommunications will be utilized as a vehicle for delivery of instruction to teachers.

RECOMMENDATION: The State Board of Education and Commissioner should urge the Colorado Commission on Higher Education to clarify future roles of the University of Northern Colorado (designated as the lead institution for teacher training) and Colorado State University (identified as the telecommunications leader in higher education). Since CSU has satellite uplink capabilities, it will be important to explore ways in which they can plan together with UNC to deliver quality programs to Colorado educators.

LIBRARIAN EDUCATION AND RE-EDUCATION:

Librarians and media specialists in the Rocky Mountain area were shocked and saddened by the announcement that the Unviersity of Denver's Graduate School of Librarianship and Information Management would close in August, 1985. Efforts were begun in the Colorado library community to seek an institution of higher education to which the only accredited graduate library program in the region could be transferred. A variety of finan-

cial, procedural, and political difficulties prevented this from happening.

The University of Colorado at Denver (UCD) has received approval from the Colorado Commission on Higher Education to expand its existing school media program into a comprehensive graduate library education program. UCD's School of Education will continue to offer only school media courses during the 1986-87 school year. However, plans call for expansion of this program within the next two years to include courses aimed at public, academic, and special librarians.

Access will still be a problem for librarians in rural parts of the state. CDE should work with CCHE to assure that plans for teacher education via telecommunications include library courses.

RECOMMENDATION: The State Board of Education and Commissioner should reiterate their commitment to an accredited graduate school of librarianship in Colorado. Further, the Board and Commissioner should work with CCHE to ensure that plans for utilizing telecommunications to deliver teacher education courses include library classes as well.

PROFESSIONAL GROWTH VIA TELECOMMUNICATIONS:

Several broadcast and satellite services offer certification, re-certification, and continuing education courses. Among these are:

Colorado State University:

CSU has prepared a flyer describing a variety of instructional programs for educators that are available on video tape or via public television stations. Complete information on each program is provided, along with details as to where the course can be taken. As part of this program, CSU announced procedures whereby local school districts can become licensed to use these video tapes on permanent loan.

KRMA-TV:

A variety of classes for teachers can be taken for credit or professional growth. Programs are broadcast at different times and can be received in the home or school. Specific courses differ from one semester to another, but cover a broad gamut of subject areas and grade levels.

National Diffusion Network:

NDN has produced a number of teleconferences for educators. These are available via direct satellite transmission and by video tape after the broadcast date. Course content covers a broad range of topics and grade levels.

Oklahoma State University:

In addition to providing satellite instruction in German and physics, schools using OSU's Public School Teleconferencing Network can also access staff development programs. These teacher courses are self-contained in

that the program is completed in one and one-half hours on a single day.

Teacher materials are mailed to participating schools prior to the telecast. Video tapes of programs are available after the date of broadcast.

TI-IN Network:

This instruction by satellite company also offers staff development and administrative support services using special equipment. Their programs could be used for teacher or parent groups in schools subscribing to the TI-IN instructional programs. TI-IN is currently implementing a pilot project in cooperation with the Coordinating Board of the Texas College and University System to deliver graduate teacher education courses via satellite with credit being offered by many colleges and univerties in Texas.

RECOMMENDATION: The CDE Certification Unit should determine whether any existing Rules need revision to permit teachers to obtain recertification credit from teleconferenceing or other alternative delivery systems such as microcomputer software.

TELECOMMUNICATIONS AND TECHNOLOGY TRAINING:

Many of us are old enough to remember when long distance phone calls were made only in the event of death or dire emergency. Hence, it should come as no surprise that people require time to change their behavior patterns toward technology. This means that training of existing staff will be critical to successful implementation of technology within a school or library. Even more important than providing staff training will be the opportunity for administrators and governing board members to learn more about how the technology will improve organizational efficiency.

Teachers need to be offered some inducement to take courses which retrain them to utilize telecommunications and technology effectively. This might require a change in the certification Rules so teachers could be required to take coursework in technology utilization as part of their recertification requirements. (Oklahoma passed legislation of this type in 1985 and it is beginning to show results.) Training teachers how to use technology and telecommunications as an instructional tool will be as important as the technology itself.

Staff training needs in regard to technology and telecommunications utilization cover a number of separate activities. These include:

- o Initial hardware and software orientation.

- o Expanded skills training of staff who have mastered the initial training sequence.

- o Structured in-house opportunities to exchange information and experiences; e.g., users' groups. (In large agencies, there should be both inter-division and intra-division groups.)

- o Overview of new technologies; e.g., computer fairs, technology

demonstrations, etc.

o Opportunities to see utilization of new technologies first-hand and discuss utilization techniques with effective practitioners; e.g., visitations to successful projects.

o Attendance at regional and national conferences to exchange and gain information about technological developments in other states which could be replicated in Colorado.

Teachers, librarians, and administrators need to feel that they can turn to colleagues close at hand for assistance in solving technology/telecommunications utilization problems. This is especially critical in view of the fact that chances are slim the Colorado General Assembly will appropriate sufficient additional staff positions to CDE for providing technical assistance to schools and libraries. Therefore, local expertise must be identified and cultivated. CDE could play a role here, in cooperation with BOCES and RLSS, by developing an electronic bulletin board of persons having expertise in various areas of technology. West Virginia funded a successful project in which local television repair persons were trained to service microcomputers in rural areas. Similar concepts would make sense in rural Colorado.

RECOMMENDATION: CDE should assure that teacher training institutions are training teachers to use educational telecommunications and technology effectively. Specialized instruction in distance learning techniques should be included in the curriculum.

RECOMMENDATION: Teachers need to be offered an inducement to take courses which re-train them to utilize telecommunications and technology effectively. This recommendation may require a revision in certification Rules so that teachers can be required to take some recertification credits in technology utilization.

RECOMMENDATION: CDE should develop electronic bulletin boards that provide information to teachers and librarians about certification, recertification, and continuing education opportunities.

RECOMMENDATION: The "each one teach one" philosophy has worked well in the arena of adult literacy. CDE should utilize this concept to build a coterie of technically savvy trainers in all areas of the state who could provide assistance to others.

OVERCOMING PSYCHOLOGICAL BARRIERS:

Many of us are old enough to remember when long distance phone calls were made only in the event of death or dire emergency. Hence, it should come as no surprise that people require time to change their behavior patterns toward technology.

The Minnesota Technology Demonstration Sites project learned that problems regarding implementation were 20% technical and 80% human factors. In projects of this type, it is important to emphasize school climate; e.g.,

creating a climate for change. Also, emphasis on instructional goals, not technology goals, is important.

Significant research has been done in the areas of acceptance and adoption of technological innovation. Findings indicate that decisions to use technology are related to financial costs and degree of need. Certainly, such factors as ease of use and availability of the technology also play important parts.

Targeting Those to Reach:

Acceptance of new technological innovations by individuals could be divided into three groups: "trend-setters" who relish the opportunity to be the first to use a new concept, "pragmatists" who realize that a new technology will either assist them in doing their jobs more effectively or make life easier in general, and "foot-draggers" who only come to technology kicking and screaming.

Realistically, not everyone within an organization needs to adopt a new technology to make it successful. However, a high percentage of potential users must be convinced to accept technological innovation before it becomes a matter of general practice. Trainers should aim their message to "pragmatists" within the organization, since the "trend-setters" will need little encouragement, and the "foot-draggers" have developed a number of avoidance skills.

Role of Professional Associations:

One approach to utilize in introducing technological innovation is to exert peer pressure. Professional associations can be valuable allies in reaching reluctant potential users. Activities can range from introductory explanations of the technology to specialized training on particular components. If professional associations can offer continuing education credits for participation at such presentations, that would enhance the possibility of attendance.

RECOMMENDATION: CDE should work with professional education and library associations to identify methods of assisting administrators, board members, teachers, and librarians in overcoming psychological barriers to using technology and telecommunications effectively.

IMPLEMENTATION STRATEGIES

All recommendations in this Study are aimed at implementation of a statewide educational telecommunications network, but some specialized activities must be undertaken if the network is to be successful. These activities can best be described as "marketing", a word usually applied in the business world. However, a statewide educational telecommunications network is an important new product—one that will require careful marketing to decision-makers and practioners alike.

CDE's ROLE:

The State Board of Education must not only declare educational telecommunications is its top priority. The Board and Department must sell this concept to local school districts and local communities. This is where a public information project with the Colorado Association of Broadcasters or the Colorado Cable TV Association would be helpful in spreading the word to citizens. KUNC, Channel 4 in Denver, has indicated an interest in developing a series of Public Service Announcements with CDE to be shown on television stations across the state.

CDE cannot accomplish implementation of this Study alone. It will be up to the Department of Education to convince school districts and libraries that their best interests will be served by identifying educational technology and telecommunications as their top priority, too. Local schools and libraries will need to analyze the Study's recommendations and identify those that coincide with their own goals and objectives.

Then, local agencies will need to build the support of their communities for improving access to technology. One way to promote local support is by working with local radio and television stations to inform citizens that effective utilization of technology is a top priority for Colorado. Local cable television companies could provide support, especially to schools using instructional satellite programming.

At the Governor's High Tech Forum, held July 9, 1986, one speaker noted that he hoped people would eventually embrace technology like they have accepted "Post-It's" (the ubiquitous yellow sticky notes made by the 3M Company). He mentioned that people have invented uses for "Post-It's" that the creators never dreamed of. In fact, "Post-It's" solve so many office problems, workers often share ideas for possible uses with colleagues and friends. Our goal should be to develop an educational telecommunications network that provides teachers, librarians, and administrators with as simple and useful a tool as "Post-It's".

RECOMMENDATION: CDE must sell the concept of a statewide educational telecommunications network to local school districts and local communities. A commercial television station should be approached to produce Public Service Announcements which could be distributed to all TV stations in the state as a means of informing citizens about educational telecommunications and technology.

RECOMMENDATION: CDE should submit proposals to the Colorado Broadcasters Association and the Colorado Cable Television Association requesting their assistance in implementing this Study. Assistance could take the form of technical advice to remote school districts and libraries, equipment repair, or provision of satellite downlink capabilities.

RECOMMENDATION: CDE should publish a series of booklets providing guidance to schools and libraries concerning factors to consider before making technology/telecommunications decisions. In addition, the Depart,ent should develop a series of electronic bulletin boards that would contain similar, but more time-dependent, information. These bulletin boards would also provide a means for local agencies to compare notes, share ideas, and exchange information on implementation strategies.

RECOMMENDATION: All CDE staff should be recruited to the task of marketing the concept of using telecommunications to enhance the quality of instruction and information access. CDE Regional Field Coordinators and Accountability Consultants should be given special training and responsibility in this area.

UTILIZING EXISTING RESOURCES:

Colorado State University:

They have been providing instructional video tapes to business and industry in Colorado since 1967. In 1985, CSU began satellite participation in the National Technological University. NTU leases one of the transponders for its members' use. CSU used one channel on the NTU transponder last year and plans to use two channels during the 1986-87 academic year. Both channels will be busy with NTU transmissions, but from 2 to 8 hours are available that could be used for K-12 or teacher programming. The amount of time actually available will depend on how much is taken by CSU activities. Hence, the Department would be wise to make it desires known to CSU as soon as possible.

CSU is currently involved in a Kellogg grant "to develop a research and pilot program to extend higher education and state library resources to rural communities by means of technology." The Colorado State Library is also participating in this project, along with the public libraries in Craig and Meeker.

KRMA-TV:

The station began broadcasting in 1956 and currently devotes seven hours a day, Monday through Friday, to instructional programming. Over 90 cable companies and 65 translator systems carry KRMA's signal to communities too remote to receive the broadcast. During the 1985-86 school year, KRMA's offerings totaled 87 series and 1,472 individual programs.

The Denver Public Schools have held the license for KRMA since its inception. However, they have notified the station management that budgetary considerations have caused them to decide to divest DPS of this responsibility. The station is currently exploring how to make this transition in

the most effective manner.

RECOMMENDATION: KRMA's instructional programming is a vital resource for school districts in Colorado and elsewhere in the Rocky Mountain West. The Department of Education should seek funding in its FY'88 budget request to assure continuation of this service. The amount that would be required to continue KRMA's programming is miniscule when compared to the expenditures that would be needed to replicate it if service were allowed to terminate. [Repeated from Funding section.]

RECOMMENDATION: The Technology Utilization Council should explore whether KRMA's signal can be uplinked to a satellite to increase its reception area. A possible collaborative effort between CSU and KRMA should be explored in order to eliminate the cost of creating a new uplink capability

at KRMA. Possible use of the state microwave system or AT&T's new fiber optics technology should also be explored so that the most cost effective transmission mode can be identified.

KTSC-TV:

KTSC-TV in Pueblo broadcasts instructional television programming 6 hours a day/30 weeks a year. Elementary school classes are telecast from 8:00 a.m. to noon, Monday through Friday. The station feeds high school programs from midnight to 2:00 a.m., 5 days a week/September through January. Schools with video tape recorders can copy the series for later use.

KTSC broadcasting reaches 58 school districts in the eastern, southeeastern, and southern parts of the state. Several cable companies carry the signal and translators spread the reception area.

RECOMMENDATION: The Director of Telecommunications should meet on a regular basis with key technical resource providers in the state. These would include: Division of ADP, Division of Telecommunications, KRMA-TV, KTSC-TV, CSU, and others. The purpose of these meetings would be to exchange information about new or emerging telecommunications technologies and to determine the appropriate role for each participant.

Professional Associations:

CDE should work with professional education and library associations to inform them of this Study's recommendations, seek their concurrence, and solicit implementation suggestions. The Colorado Association of School Boards convention in December, 1986, will provide CDE its first opportunity to inform school decision-makers of the Study's recommendations. A major session should be conducted and copies of the Study's Executive Summary should be printed in time for distribution at this conference.

Role of BOCES and RLSS:

The Department of Education will need to build support for the Study among

local schools and libraries. Colorado's Boards of Cooperative Educational Services and Regional Library Service Systems can form the basis for regional clusters that will assist in implementation of a statewide telecommunications network. Regional clusters would still permit larger school districts or libraries that wanted to assume their own responsibility for equipment purchase, staff training, etc., to do so. Just as a certain critical mass is required to deliver Special Education in a cost-effieient manner, regional clusters could facilitate introduction of effective use of technology in Colorado's schools and libraries.

RECOMMENDATION: Boards of Cooperative Educational Services (BOCES) should form the basis for regional clusters that would assist schools in network implementation. Even though there is no legal relationship between the CDE and BOCES, the Special Education model of designating "administrative units" could be used. This format would permit larger school districts that wanted to assume their own responsibility to do so, but would permit small districts to utilize the BOCES for assistance in equipment purchase, staff training, etc.

RECOMMENDATION: Regional Library Service Systems (RLSS) should form the basis for regional clusters that would assist libraries in network implementation. Current state Statutes permit such a partnership among local libraries, RLSS, and the State Library.

RECOMMENDATION: BOCES and RLSS should plan together to develop an integrated process for providing access to instruction and information to all citizens of their region. School boards should familiarize themselves with automation and networking plans already underway among academic and public libraries in their communities.

RECOMMENDATION: Installation, maintenance, and repair of equipment can be a real problem for schools and lbiraries in rural areas. CDE, in cooperation with BOCES and RLSS, should explore creative approaches to identifying local expertise that may exist or could be developed within each region. Local phone companies, cable television stations, and other corporations could be approached to provide expertise in dealing with problems such as garbled data transmission, and equipment maintenance.

BIBLIOGRAPHY

Adrian, Merv. "We All Know Them When We See Them, But Micro-Mainframe Links Tend to Transcend Taxonomic Categories; Herewith a Look at Three Subphyla." Information Center. (April, 1986), pp. 21-33.

Agency for Instructional Technology. ITV Utilization Ideabook, 1986. Bloomington, IN: AIT, 1986.

Alaska Department of Education. Office of Educational Technology and Telecommunications. Educational Telecommunications for Alaska. Juneau: The Department, April, 1982. 4v.

_____. Office of Planning and Research. Educational Telecommunications for Alaska. Juneau: The Department, January, 1977.

Arthur Anderson and Company. Planning for Data Processing in Colorado School Districts. Denver: Arthur Anderson, 1962.

Asimov, Isaac. "Global Conference." American Way. (April 1, 1986).

Asp, William G., Alan D. Lewis, and Patsy A. Tupper. Electronic Mail and the Minnesota Department of Education. Office of Library Development and Services, 1986.

Association for Higher Education of North Texas. College Transfer in the North Texas Area. Richardson, TX: The Association, 1985.

_____. "Tapping New Resources: Research Expertise at Universities in North Texas." Richardson, TX: The Association, undated.

Association of Colorado Educational Television Centers. ETV in Colorado. Denver: The Association, 1967.

Association of State Institutions of Higher Education in Colorado. Television for Higher Education in Colorado. Denver: The Association, 1964.

Barker, Bruce O. "Live Via Satellite: Interactive Distant Learning in America's Rural Schools." A paper presented at the Sixth Annual Colorado Rural and Small Schools Conference. Fort Collins, CO: June 30, 1986.

Becker, Joseph and Hayes, Robert M. A Plan for a Wisconsin Library and Information Network: Knowledge Network of Wisconsin. Madison, WI: Wisconsin Department of Education.

Benson, Gregory M., Jr., Stiglmeier, Carol anne, and Stoll, Peter F. "Telecommunications in New York State: Background and Educational Capacities." Albany: New York State Education Department, April, 1985. (unpublished).

Boucher, Virginia. Colorado Library Network Plan: A Network for Sharing. Denver: Colorado State Library, 1977.

Brown, Roger W. "Computer Chronicle: Utilizing Technology in the State Administration of Special Education, 1984." Quincy, MA: Massachusetts Department of Education, 1984. (unpublished).

California State Postsecondary Education Commission. Linking Californians for Learning: Next Steps for Telecommunications in California Postsecondary Education. Commission Report 81-28. Sacramento: The Commission, 1981.

Carnegie Commission on Higher Education. The Fourth Revolution: Instructional Technology in Higher Education. New York: McGraw-Hill Book Company, 1972.

CD-ROM Review. The Premier Issue. (Summer, 1986).

Colorado Commission on Educational Telecommunications. A Progress Report. Denver: The Commission, 1967.

Colorado Commission on Higher Education. "Report to the Colorado General Assembly on Education." Denver: The Commission, March 30, 1986.

Colorado Department of Administration. ADP Master Plan. Denver: The Department, 1982. 3v.

_____. ADP Performance Evaluation of the Department of Revenue. Prepared by the Division of ADP, Statewide ADP Plans and Coordination Section, Standards and Evaluation Unit. Denver: The Department, 1974.

_____. Colorado Real-Time Office Network. Denver: The Department, 1981.

_____. Department of Social Services ADP Performance Evaluation. Prepared by Division ADP, Plans and Coordination Section, Standards and Evaluation Unit. Denver: The Department, 1974.

_____. Division of Communications Long Range Plan, 1982. Denver: The Department, 1981.

_____. Information Systems Study of the State System of Community Junior Colleges. Prepared for the Division of Community Colleges of the State Board of Community Colleges and Occupational Education by the Division of ADP, State ADP Plans & Coordination Section. Denver: The Department, 1976.

_____. Strategic Planning Task Force. Information Systems Strategic Plan. Denver: The Department, December 1, 1985. 2v.

_____. Division of Telecommunications. Long-Range Telecommunications Plan for the State of Colorado. Denver: The Department, 1986.

Colorado Department of Education. "Educational Telecommunications." Chapter XI in Issues in Education. Prepared by Frank Anderson. Denver: The Department, 1972.

_____. Progress and Culmination: Report. Prepared by Sandy Lardinois, Electronic Mail Coordinator. Denver: The Department, 1986.

_____. Telecommunications Study for Colorado Libraries. Prepared for the Colorado State Library by Kenneth R. Harmon, Denver Research Institute. Denver: Colorado Department of Education, 1986.

Colorado Department of Labor and Employment. Business Systems Planning Report. Denver: The Department, undated.

Colorado Governor's Commission on Public Broadcasting. First Report of the Governor's Commission on Public Broadcasting. Denver: The Commission, 1980.

Colorado Governor's Commission on Public Telecommunications. "Public Telecommunications Project." Denver: The Commission, 1981. (unpublished).

Colorado Governor's High Technology Cabinet Council. High Tech in Colorado: Maintaining Our Competitive Edge. A paper prepared for the Governor's High Technology Forum, July 9, 1986. Denver: The Council, 1986.

Colorado Telecommunications Action Committee. Design and Implementation of a Colorado Educational Telecommunications System: A Report to the Colorado Legislature. Denver: The Committee, 1973. 3v. and Supplement.

Colorado, University of at Denver. Dividing Up the Phone Company: New Rules for Telecommunications. Prepared by the Center for Public-Private Sector Cooperation and the Institute for Urban and Public Policy Research. Denver: UCD, 1983.

Cook, John E. "Creating a Statewide Computer Education Network." School Shop. (April, 1985), pp. 32-35.

Corporation for Public Broadcasting. EduCable: Evaluation of Station KUON-TV, Lincoln, Nebraska. CPB Technical Report #8006. Washington, D.C.: CPB, 1980.

Denver Research Institute. A Proposal: Telecommunications Policy Planning for the Denver Metropolitan Area. Denver: The Institute, 1972.

Denver, University of. Graduate School of Librarianship and Information Management. Telefax Library Information Network. Denver, CO: University of Denver, 1979. 2v.

ECMECC and Minnesota Council on Quality Education. Technology in Education: Two-Way Interactive Television. The Authors, 1985

Fletcher, Jerry. "Applications of Electronic Technologies to Rural Education." Paper presented at the Workshop on Telecommunications in the Service of Rural Education. Washington, D.C.: National Institute of Education. July, 1980.

Florida State Department of Education. A Report to the Florida Legislature on Developing a Florida Information Resource Network. Tallahassee: The Department, 1982.

_____. A Report to the Florida Legislature on Developing a Florida Information Resource Network (FIRN). Second edition. Tallahassee: The Department, 1983.

Fred Meyer Charitable Trust. "Five Groups Receive Special Grants to Improve Information Delivery". Press Release, March 3, 1986.

Gorin, Robert S. and Kanen, Ronald A. Florida Library Information Network Project: A Comparative Study of OCLC, TWX, U.S. Mail and Closed-Circuit Teletype. Tallahassee: State Library of Florida, 1981.

Harper, James. "The Maryland Education Technology Network: The First Year, IBM Sites." Owings Mill, MD: Maryland State Department of Education, Division of Instructional Television. May, 1986. (unpublished).

Hobbs, Daryl. "Bridging, Linking, Networking the Gap: Uses of Instructional Technology in Small Rural Schools." A paper prepared for the National Rural Education Forum, 1985. Washington, D.C.: U.S. Department of Education, 1985.

Hofmeister, Alan M. and Atkinson, Charles A. The TELEPAC Project: A Service Delivery Model for the Severely Handicapped in Rural Areas. Logan, UT: Utah State University, May, 1975.

_____. "The TELEPAC Project: A Service Delivery Model for the Severely Handicapped in Rural Areas." A paper presented at the Annual International Convention, The Council for Exceptional Children. Logan, UT: Utah State University, April, 1976.

Indiana State Commission for Higher Education. "Increasing Educational Efficiency Through Technology." Commission discussion and background materials. Indianapolis: The Commission, 1981.

Information Systems Consultants, Inc. "State and Commercial Bibliographic Activities and Their Effect on the Bibliographic Utilities." A Report prepared for the Network Advisory Committee to the Library of Congress, March, 1983 and expanded August, 1983. (unpublished).

Johnson, Byron A., Murry L. Rosenthal, and Warren L. Wade. Educational Telecommunications for Colorado. Developed for the Colorado Commission on Educational Telecommunications. Colorado Springs, CO: Systems Development Corporation, 1971.

Johnson, William H., et al. "Use of Technology to Link Educational Resources and Extend Quality Instruction to All Areas of the State." Presentation for Colorado House of Representatives Education Committee: January 23, 1986.

Kansas State Facilitator Office. NDN Satellite Video Teleconferences Catalog. National Diffusion Network, 1986.

King Research, Inc. Interlibrary Loan Compensation Plan for the Commonwealth of Pennsylvania. Harrisburg, PA: State Library of Pennsylvania, March 15, 1985. 2v.

KRMA-TV. Department of Learning Services. 1985-1986 Instructional Television Schedule. Denver: KRMA, 1985.

Maine Department of Educational and Cultural Services. Planning for the Use of Technology in Special Education: A Guide for Maine's Special Educators. Augusta, ME: The Department, 1986.

Mancall, Jacqueline C. "Training Students to Search Online: Rationale, Process, and Implications." Drexel Library Quarterly. (Winter, 1984), p. 64.

Maxwell, Lee, et al. "Recommendations on Educational Media for Use in the Outreach Programs of NECBOCES." (unpublished).

Metroplex High-Technology Education Task Force. A Roadmap for High-Technology Education in the Dallas-Fort Worth Metroplex. Dallas/Ft. Worth, TX: The Task Force, December, 1984.

Minnesota Association for Supervision and Curriculum Development, Minnesota Association of School Administrators, and Minnesota Department of Education. A Compilation of Considerations Regarding the Use of a Computer to Help Teach the School Curriculum. St. Paul: Minnesota Curriculum Services Center, undated.

Minnesota Department of Education. Minnesota Technology Demonstration Sites. St. Paul: Minnesota Curriculum Services Center, 1986.

_____. Planning for Educational Technology. St. Paul: Minnesota Curriculum Services Center, 1983.

_____. "Report on the State Dissemination Leadersip Conference and Summary of the Telecommunication Experiment." Washington, D.C.: National Institute of Education, 1981.

Montana State Library Commission. Montana Library Federations 1984: Report of the Federation Review Committee of the Montana State Library Commission. Helena, MT: The Commission, 1984.

National Commission on Libraries and Information Science. Annual Report. Washington, D.C.: The Commission, 1985.

_____. Task Force on the Role of the School Library Media Program in the National Program. The Role of the School Library Media Program in Networking. Washington, D.C.: The Commission, 1978.

Nebraska Education Technology Consortium. "A Report to Dr. Joe E. Lutjeharms, Commissioner of Education and the Nebraska State Board of Education." Lincoln: The Consortium, August 23, 1985.

New York State Education Department. "Learning Technologies and Telecommunications in New York State: Action Recommendations." Approved by the Board of Regents on May 24, 1985. (unpublished).

Newsham, Michael A. Colorado Western Slope Document Delivery Study. Durango, CO: Southwest Regional Library Service System, November, 1978.

Northwest Kansas Educational Service Center. "Slow Scan Television Project: A Model Demonstration Venture." A proposal submitted to Colorado Video, January 25, 1985.

Ohio State Library. "Issues Involved in Using Microcomputers in Libraries: An Overview." Columbus: The Library, December, 1985.

Parshall, Lucian. "Special Education Technology Plan." Lansing, MI: Michigan Department of Education, 1986. (Draft report).

Pennsylvania Department of Education. Bureau of State Library. Pennsylvania Online: A Curriculum Guide for School Library Media Centers. Harrisburg, PA: The State Library of Pennsylvania, October, 1985.

Picus, Larry and Holznagel, Donald. "Electronic Communication Networks for Education: Policy Implications for SEA's." A Discussion Draft Prepared for the Chief State School Officers of the Northwest and Pacific. Portland: Northwest Center for State Educational Policy Studies of the Northwest Regional Educational Laboratory, June, 1983.

Reynolds, Dennis. Library Automation: Issues and Applications. New York: R. R. Bowker Company, 1985.

Speer, R. D. & Associates. Aerospace & Telecommunications in Colorado: Characteristics of Colorado's Aerospace and Telecommunications Industries. Boulder, CO: R. D. Speer & Associates, 1984.

Stile, Stephen W. and Atkinson, Charles M. "Project TELEPAC: Packaged Home Instructional Materials for Parents of the Severely Handicapped: A Concept Analysis." A paper presented at the Annual International Convention, The Council for Exceptional Children. Logan, UT: Utah State University, April, 1976.

Tenopir, Carol. "Online Searching in Schools." Library Journal. (February 1, 1986), pp. 60-61.

Texas Woman's University. School of Library Science. "Mobilizing Information Resources in the West: Strategies for the 1990's." A proposal prepared for the Western Council of State Libraries, Inc. October, 1984. (unpublished).

Veaner, Allan B. "Working Paper on Network Organization and Administration." A report prepared for the Network Advisory Committee to the Library of Congress. (unpublished).

Ward, James M. Final Report of the Colorado ETV Commission. Denver: The Commission, 1962.

Western Interstate Commission for Higher Education. "Library Networking in the West: The Next Three Years." A working paper describing goals and tasks to which western library organizations are committed to foster interstate resource sharing. Boulder, CO: WICHE, 1975. (unpublished).

_____. "A Proposal for Development and Implementation of a Western Interstate Bibliographic Network." Boulder, CO: WICHE, 1975. (unpublished).

Winn, Bill, et al. "The Design and Application of a Distance Education System Using Teleconferencing and Computer Graphics." Educational Technology. (January, 1986).

Wisconsin Department of Public Instruction. "A Satellite Receiver Primer for Schools." Madison: The Department, September, 1984.

World-Wide Education and Research Institute. Creation of a Telecommunications Network for Vocational Education in Utah. Salt Lake City: Utah State Office of Education, 1982.

Zakariya, Sally Banks. "In School (As Elsewhere) the Rich Get Computers; The Poor Get Poorer." The American School Board Journal. (March, 1984).